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THE
AMERICAN FARMER'S
HAND-BOOK;

CONTAINING

DIRECTIONS FOR CLEARING, DRAINING, AND FERTILIZING LAND;
SOWING AND HARVESTING EVERY DESCRIPTION OF CROPS;
TREATS OF THE MANAGEMENT AND BREEDING OF
DOMESTIC ANIMALS; DESCRIBES THE BEST MANNER
OF MANAGING DAIRIES, PRODUCING
HONEY, SUGAR, WINE, CIDER,
ETC., ETC.

TO WHICH IS ADDED

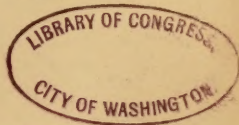
MANY TABLES OF WEIGHTS AND MEASURES.

BY

AN ASSOCIATION OF PRACTICAL AGRICULTURISTS.

RE-EDITED, WITH NUMEROUS ADDITIONS,

By F. W. O'NEILL AND H. L. WILLIAMS.



Illustrated by nearly 400 Engravings.

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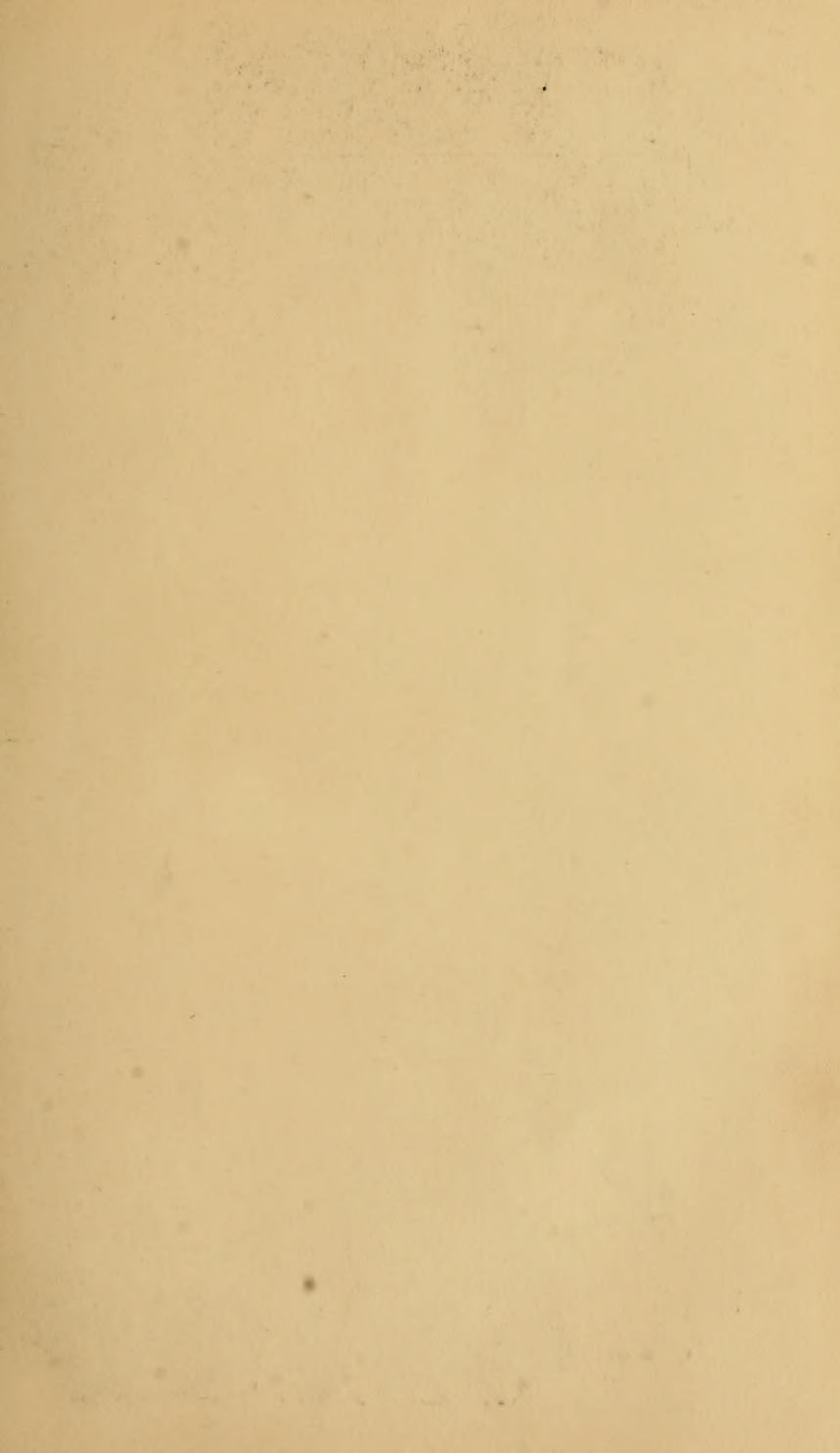
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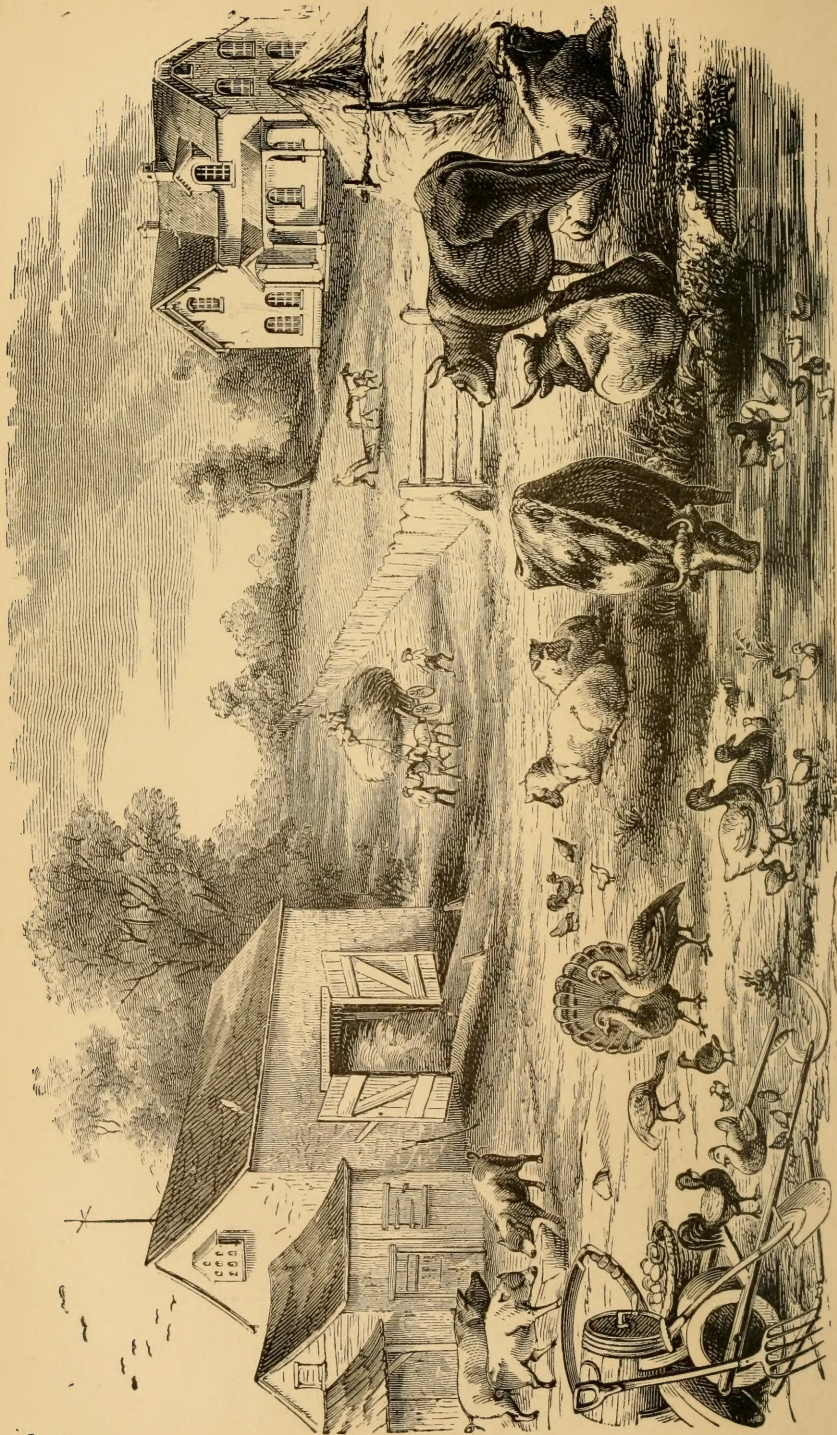
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P R E F A C E

TO

T H E N E W E D I T I O N .

THE very flattering approval with which THE AMERICAN FARMER'S HAND-BOOK has been greeted by the agricultural community, has encouraged the publisher to endeavor to extend its sphere of usefulness, by incorporating in its pages such additional material as the progressive spirit of agricultural inquiry has rendered available; hence, the reader will find the modest book, with which, perhaps, he was familiar in bygone days, now assuming dimensions of a more dignified and imposing character. Much of the matter now presented in this volume for the first time, and which cannot be found elsewhere, except in books devoted to special subjects, is of a highly valuable as well as important nature, well deserving the undivided attention and careful perusal of all who are engaged in agricultural pursuits; and we trust it may have the effect to arouse an interest in the cultivation of many plants which have as yet attracted but little notice.

The radical error of the American system of farming is that, throughout the greater part of the country, the attention of farmers and planters has been almost exclusively devoted to the cultivation of a few staple articles, such as wheat, rye, oats, Indian corn,

cotton and tobacco ; while many very profitable branches of rural economy, such as green crops, grape growing, fruit raising, and garden truck have met with comparative neglect. This has arisen in part from the tendency which people in general, of all professions, have to fall into ruts, and pursue a certain routine simply because it is routine.

It requires some sudden shock or violent alteration to bring the masses into seeing the necessity of making any vital change in the course they have been pursuing. Within the last twenty-five years our country has sustained several sudden and important political and financial changes and convulsions that have had great and lasting effects upon agriculture, manufactures and commerce. California has shown her ability to be one of the greatest grain and fruit producing countries upon the face of the earth ; Texas has developed a capacity for raising stock and cultivating cotton and grain which has literally amazed even the most hopeful of her citizens ; the great West pours out train after train of wheat, corn and pork in one continuous stream. At first sight this would appear injurious, if not ruinous, to many of the older States, prolific as they are compared with most parts of the earth. But such is not the case. Fortunately almost simultaneously with these grand developments of agricultural richness, the manufacturing powers of the country took an immense stride in advance, and have created markets at the very doors of our farmers for every article which they can produce.

Great improvements have been introduced in the culture of vegetables and fruits. Our cattle have been so much bettered by judicious breeding that even English stock-raisers have bought bulls and cows from us at what seem almost incredible prices. The quality of our sheep has improved both in their meat-producing and wool-yielding. In every kind of market gardening there has also been a wonderful improvement. Fruits, large and small, have partaken of the same astonishing progress ; until now it is a common thing to see in any of our city markets apples and pears, plums, nectarines, grapes,

and the lesser fruits, that equal and in some varieties surpass those produced in the finest fruit raising countries of the world.

The products of our dairies not only find a ready and remunerative sale in our own markets, but they command a quick and profitable sale in countries that have been deemed beyond our competition.

Our leading statesmen, merchants and manufacturers have taken a lively interest in promoting in every way the heathful progress of agriculture. Knowing well that in a country where that profession is profitably employed, fairly compensated and duly honored, not only does wealth accumulate, but man—the noblest product of every country—flourishes “erect and free.”

The many Agricultural Societies formed in the various States have had a very favorable influence upon the development of farming in all its branches, by bringing into comparison and competition almost every kind of grain, roots, fruits and dairy products ; as well as the different kinds of improved mechanical implements.

Another great advantage springing from these societies and clubs is that they necessarily lead to the interchange of opinions, and a comparison of methods between men fully alive to the fact that there is no such thing as standing still in farming. The farmer's motto is that of New York State, “Excelsior.”

A very profitable—though somewhat remote profit—will be found in the preservation and propagation of our forest trees. Their judicious cultivation will prove not only a source of wealth to the individual cultivator, but the country at large will be immensely benefited by the growth of the forests. Vast tracts of country, more or less mountainous, and now scalped of the grand foliage which once adorned them, may at little outlay be made to grow many of our noble native trees, the woods of which are daily becoming more and more valuable for ship and housebuilding and for the manufacture of furniture.

Many vegetable oils and dyestuffs have been of late years much neglected ; their scarcity will produce a demand, and then they

must then rapidly advance in price. Under the appropriate headings, the reader will find full and accurate instructions as to the soil and mode of culture best adapted to the oil and dye-yielding plants, together with a statement of their uses, and of the methods of extracting their valuable properties.

Recently, considerable attention has been directed to the introduction of the Sorgho, or Chinese Sugar-Cane, and its congener, the Imphee, or African Sugar-Cane—both of which were opportunely discovered at the very period when, owing to a radically-defective system of cultivation, the exhausted plantations of Louisiana refused to yield their usual product of sugar. These plants have been fully treated of in this volume; as also the sugar-beet, a plant of inestimable value in France, where its culture, and the manufacture of sugar from its roots, profitably employ immense numbers of the population. Cotton, tobacco, and rice have likewise been lengthily discussed; and, as a vessel is now on its way to our shores with large quantities of tea-plants and seed, imported by the Agricultural Bureau of the Patent-Office, with a view to the introduction of the culture of this plant in the United States, it has been deemed necessary to include a description of its varieties, together with their mode of culture, and the process employed for manufacturing the leaves into the tea of commerce. The silk culture, once an object of ephemeral attention, and, without good reason, consigned to oblivion, has also received due attention; for it is, practically, a very important branch, and, within the limits of the Union, there are very few localities wherein silk cannot be produced with great advantage to the grower. Of equal importance are the instructions in regard to the management of vineyards, and the manufacture of wines, when the extent of country adapted to the growth of the grape is taken into consideration, together with the vast field which its culti-

vation presents for the profitable investment of surplus capital and labor.

We take the liberty here to warn our farmer friends against two very serious and prevalent errors, which have already done much to retard the progress of desirable improvements in agricultural science—one of these is incredulity, which so obscures the perceptive faculties of the individual, as to prevent him from realizing the benefits to be derived from scientific investigation—the only solid basis of a really progressive agriculture; while the other is the opposite extreme—over-credulity, which induces improvident expenditures for new machinery, plants, seeds, manures, etc., that have not been thoroughly tested by a series of careful experiments, and their adaptation to the particular locality clearly ascertained. In the case of new seeds and plants, one experiment should never be deemed a sufficient test; nay, even two, three, or four will sometimes be too few to determine whether they can be profitably cultivated; and in no case should the farmer abandon the cultivation of any plant which has been recommended by competent and scientific agriculturists, until, by repeated trials on a small scale, he has satisfied himself that it is either unsuited to the soil, or cannot be grown with profit.

In the Appendix will be found a collection of Tables, of great service to the practical agriculturist, who, by their aid, may measure his own land; ascertain the weight of his cattle by merely taking their girth and length; find how many plants can be raised on each perch and acre of ground, at definite distances; learn what are the best mixtures of grass-seed for sowing on different soils, whether for pasture, mowing, or other purposes; determine how many heaps of manure will be required to cover an acre of ground at different

distances, as well as the number of loads to the acre ; and at a glance, satisfy himself as to the amount of ground he can plough per day, with certain widths of furrow slice, and at certain rates of speed.

In the following pages we present our readers with engravings of different kinds of implements used in farming. They are such as have been thoroughly tested and have been found to fulfill the objects for which they were intended.

As almost every day brings before the public the claim of some inventor who desires to introduce a new article to lessen the demand for manual force, or to execute work with more rapidity and perfectness, we cannot in justice to them or to contemplated purchasers do anything but advise buyers to make personal examination, with the assistance of experts, before laying out money for what may prove little or no improvements over the time-tested implements they already have in use. While on this subject we may say that we thank Mr. A. B. Griffin, of New York, for some of the modern engravings which appear in the volume. It is not good to multiply labor-saving agricultural machines without reflection. Mr. Frank Wilkeson, a very able writer on Agricultural matters, recently remarked :

“There has been a great deal written about our labor-saving harvesting machinery, and most people think they are money-saving machines also. This is a mistake. With the single exception of the header (and this tool cannot be used in a damp climate) none of them save money. They save labor, but not money. They enable one man to do the work of three or four men, but he does it at the price of four or five men’s work. Instead of the money being paid to the farm laborers of the agricultural regions, it is sent out of the farming districts into the manufacturing districts to pay for machinery and binding wire. An improved self-binding harvester costs \$300 ; an old-fashioned cradle costs \$4 ; and with equal care the cradle will outlast the binder. Where men are plenty the grain can be cut cheaper with a cradle than with a self-binder.”

PREFACE.

IN presenting to the American public a work on AGRICULTURE AND THE VARIOUS ARTS AND SCIENCES CONNECTED WITH ITS MORE PERFECT KNOWLEDGE AND PRACTICE, we feel that we should hardly be satisfied with the common prize of authorial ambition,—the mere approval of our book by the community at large. We should be far better pleased, could the volume be the means of so stimulating scientific inquiry and advancing the noble cause of Agriculture, that the very work itself should soon be superseded by the improvements it may cause.

It would be an easy, and by no means disagreeable task, to occupy, as is sometimes the practice with authors, a score of pages, or more, with a Preface or Introduction, elaborately demonstrating the importance of agriculture to mankind in the light of political economy, and especially its vital connection with the continued advancement, in prosperity and power, of this mighty republic; and, from such premises, it would not be difficult to deduce abundant facts, principles and suggestions, valuable, in a social and economical point of view, alike to the cultivator of the soil and to all other classes of citizens. The value of many of the more difficult arts and sciences may, indeed, be appropriately dwelt upon, in text-books devoted to their discussion, from the fact that their importance is, as yet, far from being generally acknowledged, or their principles adequately understood. But who can be so blind, in this day of light, as to need any studied accumulation of evidence to show the value and magnitude of agriculture and its kindred employments? Argument

can hardly enhance them ; eloquence, in its most select phrases, can no further embellish them. The earth itself is not more the foundation on which we stand, than the cultivation of the soil is the foundation of all national existence, all political stability, all social and mental progress. What government — what community — could be sustained, what form of public or domestic happiness could be enjoyed, without food, clothing and shelter ? And does not the bulk of food, clothing and shelter, come out of the earth ? and, with very inconsiderable exceptions, are they not the result of manual toil and culture ? A few things are of spontaneous production, but the limits of spontaneous production are soon reached. Without other resources, nine tenths of the present population of the globe would perish before another annual revolution of the sun. The agriculturist, then, feeds and clothes and shelters the world. Further improvements in this great department of human effort would enable it to feed and clothe and shelter the world with more adequacy, with greater comfort, with a higher ornament. Advanced still further, other tens and hundreds of millions of beings might rejoice in its bounties ; and human imagination cannot assign a limit beyond which the creative, or, at least, the sustaining power of agriculture cannot go, in filling the ranks and improving the races of mankind. The correctness of these views, however, it has been presumed, is the conviction of every intelligent agriculturist in this country ; and if to this were added a due appreciation and improvement, on his part, of the means afforded him zealously to fulfil the duties and responsibilities of his vocation, the speedy attainment of comparative perfection in husbandry pursuits would no longer be problematical. To the realization of this end, — so earnestly to be desired, — these pages, it is humbly hoped, will contribute in no small degree.

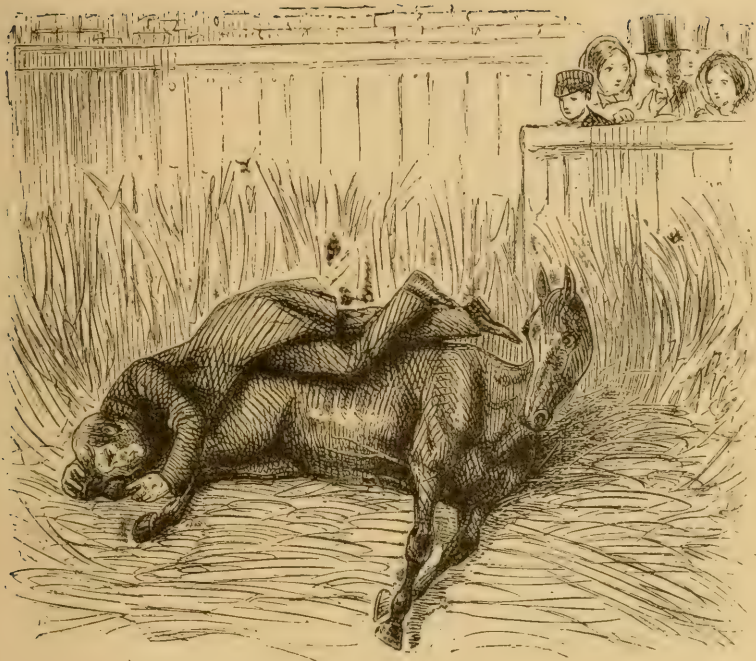
But, in addition to expatiating upon the political and physical relations of agriculture to mankind, it is not unusual for authors or editors of agricultural books, in order to excite, on the part of farmers and the community in general, an increased interest in the cause of agriculture, — as well as to commend their own labors to public favor, — to indulge in elaborate encomiums on the moral dignity of rural pursuits, and their adaptedness to ennoble the lives and char-

acters of those who engage in them. Such encomiums are just, and, in their proper place, useful and gratifying. No reflective person, however, whether he be a farmer or a tradesman, will need to be informed of the tendency of constant communion with the works and phenomena of nature to purify the thoughts, and thus exert a largely restraining influence upon the dark passions of the human soul. No man works more in the immediate presence of his Creator than the husbandman. He sees Him not only "in the cool of the day," but in every waking moment; — in the purity and fragrance of the circumambient atmosphere, — in the untamed grandeur of Nature's mountains, rocks, fields, forests, and gushing waters, — in the germination of every seed, — in the growth of every leaf and of every blade of grass, — by these, and numberless objects besides, is he impressed, not only with the power, wisdom and goodness, of Him who "causeth the grass to grow for the cattle, and herbs for the service of man," but with the gracious course of His providence, which rewards every discovery of His laws, and every act of obedience to them. It is uttering no harsh judgment, then, when we say, briefly, that the man who can live and labor, surrounded by so many and so palpable attestations of a beneficent and controlling Power above, without realizing the nearness of his relations to that Power, or without hymning in his heart devout ascriptions of praise and gratitude, is a sad example of the derangement which sometimes characterizes man's moral machinery. And if, with the Book of Nature thus unfolded so luminously before him, his feelings fail to be voluntarily awakened to a sense of the honorable character of his employment, and of his duty to improve every means and facility that will enable him to become skilful and thrifty in his calling, no words of rhetoric, however eloquent, will be able to arouse them.

Beyond, therefore, the simple assurance, to those into whose hands this work may fall, that it is the result of patient and laborious study, diligent investigation, and enlightened scientific experiment, confirmed by careful and discriminating practice, — and that it embraces within its scope every important topic or subject treated of by the most eminent practical writers on Agricultural Economy, in all its ramifications, — introductory comment on the design and character of this volume is unnecessary.

To those for whose use and benefit it has been prepared, — the AGRICULTURIST — the MARKET GARDENER — the DAIRY FARMER — the FRUIT GROWER — the STOCK RAISER — the POULTRY BREEDER — the BEE KEEPER — the FLORIST — and the RURAL ARCHITECT, — this volume is respectfully commended, with the earnest hope that it will prove to them a valuable, substantial, and profitable aid.

In the Appendix will be found a collection of Tables, of great service to the practical agriculturist, who, by their aid, may measure his own land; ascertain the weight of his cattle by merely taking their girth and length; find how many plants can be raised on each perch and acre of ground, at definite distances; learn what are the best mixtures of grass-seed for sowing on different soils, whether for pasture, mowing, or other purposes; determine how many heaps of manure will be required to cover an acre of ground at different distances, as well as the number of loads to the acre; and, at a glance, satisfy himself as to the amount of ground he can plough per day, with certain widths of furrow-slice, and at certain rates of speed.



A KICKER SUBDUED BY MR. RAREY, THE AMERICAN HORSE TAMER.

“ In Colt-breaking, to command obedience and insure confidence are the first points aimed at ; and, as such, the importance of early handling must be evident. Colts are now taken ‘ in hand ’ much earlier than formerly ; racing colts at a twelvemonth, and saddle colts of promise are now bitted and suppled at two, and are finally and fully broken and trained, some at three, and few later than four years old. If, however, the new system inducted by Mr. Rarey proves successful in breaking, not only a great saving of time with all horses, but much wear and tear of constitution with race horses will be effected.”—*Blaine's Encyclopædia of Rural Sports*, p. 287.

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CHAPTER I.

SOILS: THEIR NATURE AND TREATMENT.

THE COMPOSITION OF SOILS—THEIR CLASSIFICATION—ANALYSIS—RELATION BETWEEN THE SOIL AND SUBSOIL—MEANS OF INCREASING THEIR PRODUCTIVE POWERS, AND RENDERING THEM FIT FOR CULTIVATION, VIZ.,—ALTERING THE PROPORTION OF THEIR INGREDIENTS—CLEARING—PLOUGHING—HARROWING—ROLLING—MANURING—DRAINING—IRRIGATING—ROTATION OF CROPS.

GENERAL REMARKS.

Nothing is more true than the fact, that, from the vague manner in which soils are usually described by writers assuming to instruct those who cultivate the soil, it is often difficult for a farmer, who reads accounts of agricultural operations in any other section of the country than that in which he resides, to judge what relation the soil which is the scene of such operations bears to that which he himself cultivates. A certain acquaintance with a few of the plain principles and laws of chemistry in connection with the composition of soils is, therefore, very desirable; for it is only in the accuracy in which soils are described, and their composition and character ascertained and understood, that a knowledge of the best methods of remedying their defects, and improving them by the application of different matters, can be acquired. It will be consistent, then, with the design of our work, to give some account, in the first place, of the

I.—COMPOSITION OF SOILS.

Though various in fertility and texture, all soils are resolvable into the same constituent parts. They consist of earthy and organic matters in a state of combination. What is commonly called earth may be considered in two points of view, either as mixed or unmixed with animal and vegetable remains. As originally produced from the crumbling or decomposition of rocks, earth is, of course, destitute of any of these matters; but they very soon enter into its composition, and exist in a considerable proportion in all soils not completely barren.

The principal mineral substances which enter into the composition of rocks and soils are silica,—found in quartz, flint, and sand; alumina,—a leading ingredient in the composition of clays, giving them that softness,

plasticity, and adhesiveness, for which they are distinguished; lime,—constituting the numerous varieties of limestone, marl, chalk, and marble; magnesia,—existing in various states of combination with acids and other earths, and is found in various mineral springs. Thus, where silica prevails, as in the case of many sands, the earth may be called silicious; where clay prevails, the soil may be called aluminous; where lime exists in quantity, as in the case of chalk, the soil is calcareous; and where magnesia prevails to such an extent as to impart its distinctive nature to the soil, it may be called magnesian. Besides these, there is the oxide of iron, forming a constituent part of soils, though its influence on their productive powers has not been definitely ascertained.

II.—CLASSIFICATION OF SOILS.

Having spoken of the ingredients in soils, we will now classify them according to their peculiar properties and the kinds of crops they are severally best adapted to produce. The grand divisions are as follows:—

Clayey Soils.—These are distinguished for the adhesion of their parts, and the retention of moisture. Farm lands of this description,—the richer clays, we mean,—generally produce crops of great abundance and of superior quality, but at extra cost. Much attention is necessary to the choice of suitable seasons for conducting the operations of tillage on these soils: if too dry, it turns up in hard masses, difficult of being made fine enough for sowing; and if too wet, it is worked into mortar, and cannot be reduced by the harrow. At the first ploughing, the clay comes up in large clods; but the oftener it is acted upon by the implements of tillage at the proper time, the more is its cohesion broken, and the more easily can the roots of plants penetrate. They must be worked when the clods can be crushed by the roller.

Sandy Soils.—These are distinguished by their small degree of adhesiveness; and, with the aid of manures and consolidating substances, to counteract their poverty and their susceptibility to drought, no land pays better for improvement. The richer class of sands is fitted for the production of every kind of herbage and grain, bulbous and tuberous rooted plants.

Gravelly Soils.—Between the gravelly and sandy soils there is a close resemblance, both containing a large portion of undecomposed rocky matter. The loose texture of gravelly soils renders them unfit for the production of wheat and beans, but they are admirably adapted to barley and oats.

Peaty Soils.—While other soils consist, primarily, of the worn-off portions of rocks, combined with various animal and vegetable matters, it is otherwise with the peat soils. The matter comprising the soils of this class varies exceedingly, but in all cases it retains the general characteristics of

its origin, from the quantity of the stems and other parts of plants which it contains, either entire, or in a partial state of decay. At the surface, it may be fibrous, and of a brownish-gray color; and lower, it may be friable, of a light-brown color, and with few fibres. Still lower, it may be compact, of a deep-brown color. Wherever wood, stems, or grass of any kind, goes to waste, or falls down and is decomposed, its remains are changed into moss, if the necessary degree of humidity be present; and, a certain temperature being essential in producing this change, it is only in the cold and temperate parts of the earth that peat is formed.

Loam Soils. — Under this denomination is included that kind of soil which appears to be an intimate mixture of all the others. It is friable in its composition, and neither liable to be parched in summer, nor drenched and chilled with surface water in winter. It is suitable for every kind of crop, and every system of husbandry.

III.—ANALYSIS OF SOILS.

The constituent earths being frequently, not only mixed together in an interminable variety of proportions, but also interspersed with vegetable and animal debris, an analysis of the soil is the only certain and reliable mode by which the farmer can ascertain the presence, and amount, of the different ingredients composing the land which he has, or is about to put under cultivation. The following is the most simple process by which a separation and measurement of different earths may be effected:

Fit a cork into one end of a glass tube, three feet long and three-fourths of an inch in diameter; then half fill it with clear water, and pour into it a similar quantity of water in which has been mixed as much of the soil to be examined, as will fill about six inches of the tube. Place the tube in a vertical position, and let it stand for about one hour. An examination will then show the earths deposited in the order of sand, clay, and humus; and the proportion of the latter will indicate the quality of the soil.

IV.—RELATION BETWEEN THE SOIL AND SUBSOIL.

Clayey Subsoil. — The value of the soil for agricultural purposes is affected, in a great degree, by the nature of the subsoil upon which it lies. A retentive, clayey subsoil is in general highly injurious to vegetation; for, where the soil rests on a subsoil of this quality, it is constantly soaked with water, and is tilled with difficulty. The retention of an undue quantity of moisture diminishes the beneficial action of the manures which have been applied to the land, and the crops on such soils make but little progress. Hence, their grain is of inferior quality, and, when in grass, their herbage is coarse.

Porous Subsoil. — A porous subsoil absorbs all superfluous moisture. Below clay, and the different varieties of loam, an open subsoil is particularly desirable. It is favorable to all the operations of husbandry; it tends to correct any undue absorbent power in the soil above; and it promotes the beneficial action of manures, contributes to the growth and preservation of seeds in the soil, and insures the future prosperity of the plants. Hence it is that a thinner soil, with a favorable subsoil, will produce better crops than a deeper one, resting on wet clay, or on cold or non-absorbent rock.

Quality of Subsoil. — But not only is the soil affected by the depth and texture of the subsoil, but by its quality. There are cases when, from natural revolutions, that which is properly the soil forms the lower stratum or layer, as, for instance, where the original surface has been covered by the sand; but, in general, the lower stratum is far less suited to the nourishment of plants, and in many cases contains matter which, if too abundant, is greatly injurious to vegetation.

Depth of the Soil. — Whether the subsoil be retentive or porous, the soil which rests upon it should be of good depth; and in proportion to that depth will it be affected by the nature of the subsoil. If a retentive subsoil is placed very near the surface, not only is the soil too shallow for the purposes of vegetation, but it is too easily affected by the alternations of dryness and moisture; and if, again, a porous subsoil be very near the surface, the roots of the plants, as in the other case, not only have not sufficient space to extend themselves, but the moisture of the soil is too easily exhausted by heat, to the injury of vegetation.

V. — MEANS OF INCREASING THE PRODUCTIVE POWERS OF SOILS, AND RENDERING THEM FIT FOR CULTIVATION.

Having now explained the composition, varieties, and qualities of soils, and the connection between them and the subsoil, or lower strata, we shall proceed to point out the various means which it is necessary for the farmer to use, in order to maintain and increase their fertility, and render them fit for the grand purpose of cultivation. These grand means are as follows: —

1. ALTERING THE PROPORTION OF THE DIFFERENT INGREDIENTS IN THE SOIL. — This is done by ascertaining the composition of the soil, and then adding to, or subtracting from, the ingredients in which it is deficient, or with which it superabounds. If a sterile soil is found to contain any of the salts of iron, or any acid matter, it may be ameliorated by applying quicklime. A soil of good apparent texture, containing sulphate of iron, will be sterile; but this may be remedied by a top-dressing with lime, which converts the sulphate into manure. If there be an excess of limy matter in the soil it may be improved by the application of sand or clay. Soils too abundant

in sand are benefited by a dressing of clay, marl, or vegetable matter. Light sands are improved by using peat, and peats by a dressing of sand; though the former is in its nature only a temporary improvement. When peats are acid, or contain iron, limy matter is necessary in bringing them into cultivation. The best natural soils are those of which the materials have been derived from different strata or layers of the earth, which have been minutely divided by air and water, and are intimately blended together; and, in improving soils artificially, the cultivator cannot do better than imitate the processes of nature. To do this, the necessary materials are seldom far distant; coarse sand is often near by, and beds of sand and gravel are common below clay. The labor of improving the texture or constitution of the soil, by thus changing the character of its ingredients, is repaid by a great and permanent advantage, — less manure is required, and its fertility and productiveness insured.

2. CLEARING. — It is seldom that the operation of altering the proportion of the different ingredients of the soil can be performed to any extent until after it has been cleared; nevertheless, we have chosen this arrangement of

Fig. 1.



Fig. 2.



Fig. 3.



our subject, believing it to be the one best adapted to promote the end which we have in view, namely, a plain and intelligible presentation of principles, facts, and modes

That the chief part of waste and uncultivated lands might be turned to advantage, is undoubtedly true. Land covered with furz; the soil of ancient forests, overrun with this plant, or covered by stagnant water; those moving sands, which are often carried from place to place, in some sections of the country, by the wind; neglected tracts, which yield nothing at all, or, at most, but a scanty return; in short, almost all kinds of land are susceptible of some kind of tillage, and capable of yielding certain varieties of produce. But operations of this nature are not always attended with profit, the land often costing as much, or more, in the end, as it would have been necessary to give for such as was already in a state of cultivation.

Definite Plan of Operations. — The first thing to be done is carefully to determine on the manner in which the land about to be cleared can best be turned to account; then to lay down a plan of operation, drawn up with due regard to the nature of the soil and the ends proposed to be derived from it; and, finally, to precisely and perseveringly adhere to such plan. It is important that the improvement of the land should be commenced at that part which is most capable of being converted into meadow or pasture ground, even though it should be determined to submit this land to the plough at some future period; by so doing, a supply of manure will be insured, and the fertility of those portions of land afterwards cleared will be increased.

Clearing Forests. — It is upon the soil of forests that operations of this nature are usually performed, and it is upon such soils that they are attended

Fig. 4.

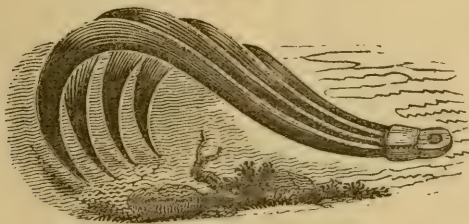


with the greatest advantages and success, both as regards the person by whom they are undertaken, and society in general. The soil of forest land

generally contains a sufficient quantity of nutritious matter to enable it to produce both crops of fodder and of corn, even without being manured with dung; and, consequently, will yield an immediate return for the expenses of clearing, without being exhausted by so doing.

The extirpation of trees and bushes often requires a great deal of labor; and, to do it more easily, several machines have been invented. Useless shrubs are readily cut down, and serve for fuel. Their roots are seldom difficult to grub up; a simple and very powerful instrument for this purpose is a very strong iron three-pronged fork, the prongs twenty inches long, and a strong handle, twenty feet long, fixed firmly into it, to the end of which a rope is fastened; this is driven slantwise under the roots, and, by means of a log as a fulcrum, it forms a lever when pulled down by the ropes. Figure 4 represents this instrument; and the succeeding cut is that of an implement now much used for the same purpose, the claws being attached to the bush close to the ground, and, by means of cattle fastened to it by a chain, the bushes or roots are easily drawn.

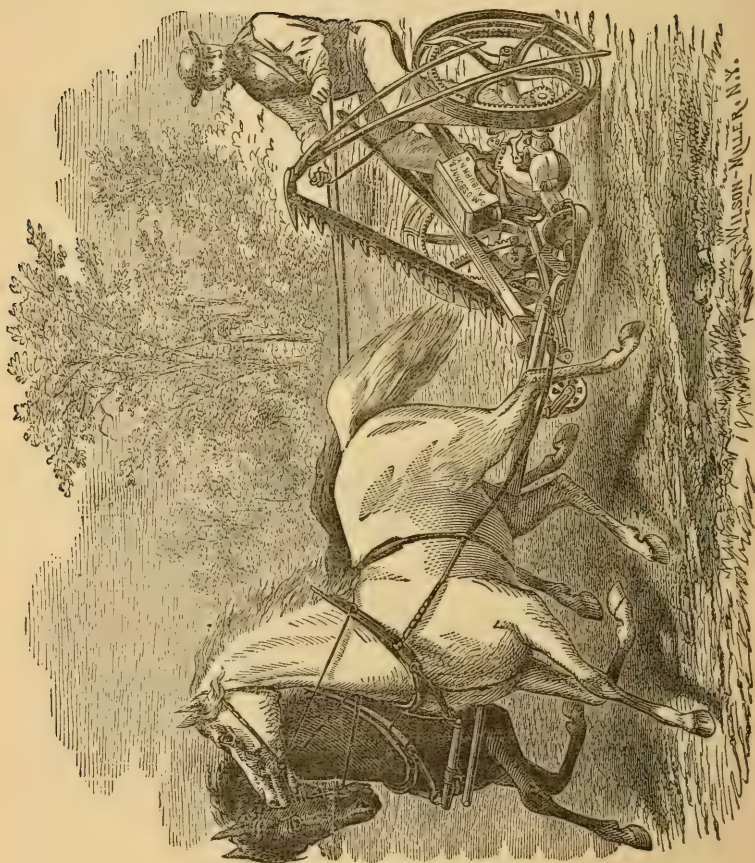
Fig. 5.



Trees, however, must be grubbed up by the roots, and old stumps must be taken out of the ground entirely, before the land can be brought into a proper condition for profitable tillage. This has always heretofore been a work of toil and difficulty; but a good invention, which is a very simple application of lever-power, has so much facilitated this operation, that a piece of ground may now be cleared of trees and stumps with as little trouble, and less exertion, than was formerly required for the eradication of small bushes. The machine by which this is effected (Willis's Stump Extractor), is represented as very effective.

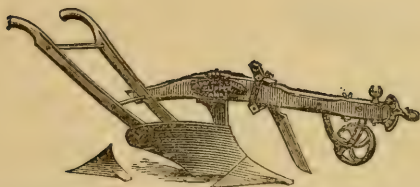
Clearing Waste Lands.—Next to the soil of forests, waste lands and common pasturages most generally require to be cleared. Land of this description is usually in a very disordered condition, the surface being not only rugged and uneven, but frequently covered with stumps of trees, bushes, &c. After disposing of these, plough with a broad sharp share. After some time, a strong harrow should be used.

Fig. 6.

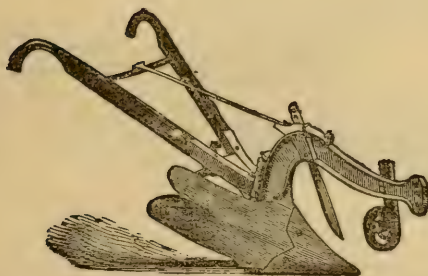


THE KIRBY MOWER.

We give this to the reader, as a specimen of one of the many dozen labor-saving implements of the day. It is said to be an excellent article of its kind, and worthy of the attention and scrutiny of would-be purchasers.



THE MOHAWK VALLEY CLIPPER STEEL PLOW.



AUTOMATIC IRON BEAM REVERSIBLE, OR SWIVEL PLOW.

It may not be amiss before going into further details to call attention to the fact that there are very many plows offered for sale, of more or less excellence. We shall not advocate the claims of any of them, but merely give one or two pictures of the most advanced and improved kinds. Every farmer must use his senses and judge from his own experience or that of his neighbors which are the best articles, not merely on general theoretic principles, but on practical grounds, and adaptability to the particular soil or crops he desires to use a plow for.

Additional about Clearing Waste Lands.—The litter of boughs, twigs, brambles, and such waste-stuff must be carefully heaped together. Then the soil will be found partly covered with tangled roots

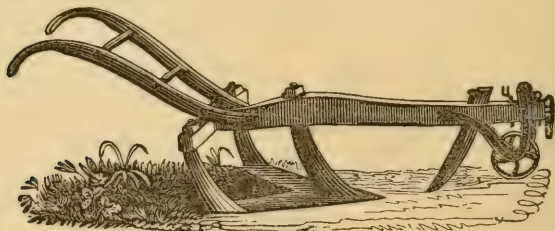
Fig. 7.



and fibres, and these must be burned. A bramble-hook, like that above, is also frequently used in cutting brush or brambles.

Paring and Burning.—Comparative experiments prove that *paring and burning* is one of the best methods employed in clearing uncultivated lands of a marly nature, though many disapprove of the practice. The operation consists in paring off the turf to a depth of two or three inches,—generally by a breast-plough, worked by hand, or by a turf-paring plough, drawn by a

Fig. 8.

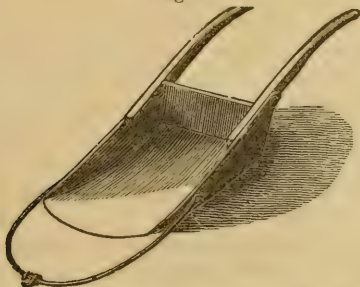


horse,—allowing it to dry, and then burning it in heaps. The result is a mixture of burned earth, charred vegetable fibre, and the ashes of that part which is entirely consumed, thus producing a powerful manure, impregnated with alkaline salts and carbonaceous matter, which, it is well known, are very powerful promoters of vegetation. Insects are also killed by the process. It is very easy to ascertain whether any soil will be improved or not by paring and burning. A few sods may be taken and exposed to heat in an iron pot closely covered over; the heat should not be so intense as to produce light, but should be kept up for a considerable time, till the sods are consumed. If the ashes are red, and the whole is a fine powder, with particles of charcoal in it, the soil from which it was taken may be safely pared and burned, especially if it forms a mud with water, and the earth is not readily deposited. But if it feels gritty, lets the water readily through, and soon settles when mixed with it, burning will not be advantageous.

Levelling Uneven Surfaces.—Frequently, when the surface of newly-cleared land is uneven, it is necessary, in the first place, to smooth and level

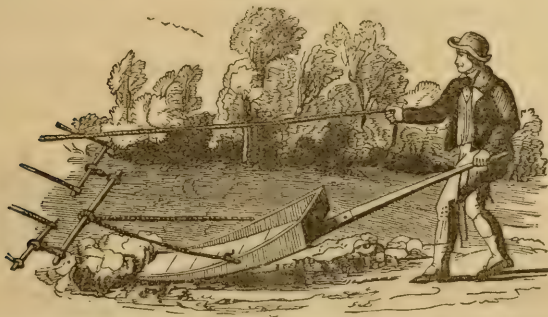
it, in order to cultivate it more easily. When the inequalities of the surface cannot be reduced by a more simple process, it may be done, when the soil is loose and sandy, by an instrument like the following; or by another, which is much used in Flanders, consisting of a wooden shovel, shod with iron, and having a long handle; about the middle of this shovel, which is convex, are two hooks, one on each side, to which chains are fixed, which unite at the bar, to which the traces of a horse or horses are to be attached; a rope fixed to the end of the handle completes the instrument. A man accustomed to the use of it raises the handle, and the shovel enters the ground, and is filled by the horse going on. By depressing the handle, the load is made to slide on the rounded bottom of the shovel, till it arrives at the place where it is to be deposited. By letting the handle go, retaining the

Fig. 9.



rope, the whole is upset instantly, turning over on the edge; the handle strikes on the bar, and the load is left behind in a heap. By pulling the

Fig. 10.



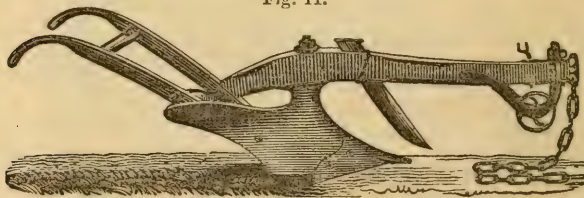
rope, the whole instrument resumes its original position, and is brought back to the place from which the earth is to be taken again, without any loss of

time, or the slightest stoppage of the horses. About five cwts. of loose earth may be thus moved at each time. This instrument is seen in the preceding cut.

Removing Stones. — The removal of large stones often increases the difficulty of clearing an uncultivated soil to a considerable extent; and yet they must be removed, at least, as far below the surface of the soil as the plough penetrates in its course, otherwise it is wholly impossible to till the ground properly. When they cannot be used for any valuable purpose, they may be sunk into the ground to a depth at which they will not interfere with any of the operations of agriculture. For this purpose, a trench deeper than the stone itself is dug all around it, and it is laid in the hollow thus formed. The width and depth of this hollow must be greater than the breadth and depth of stone, and its shape must be so contrived that the stone, when turned over, may not present either of its angles or edges to the ground. Very large stones must be blasted, especially if they are going to be used in building. The most useful mode of conducting this operation consists in the use of gunpowder; but it should be done by those who understand the operation, and with proper instruments. Another method consists in heating the stone to a high degree, by means of a fierce fire applied to one part of it only, which will cause it to expand. When the stone has been thus made intensely hot, water is poured upon it to make it crack, the effect being increased by powerful blows given with very heavy hammers. A third method consists in piercing the stone in the direction of its veins, and introducing into the hole a cleft cylinder of iron, and then driving a wedge of the same metal in between the two halves of the cylinder. Finally, a quantity of water may, during the winter season, be introduced into a hole made in the stone to a sufficient depth, the aperture to be then closed with a stopper closely driven into it. The water contained in this hole, expanding as it freezes, exerts a force sufficient to break in pieces the strongest stone.

3. **PLOUGHING.** — Ploughing is justly considered the most important of

Fig. 11.



agricultural operations, as on the manner in which this is performed depends the facility of executing all succeeding operations on the same piece

of land. The plough acts as a wedge, separating a portion of the soil, and turning it over at the same time. The manual operation of holding the plough in a proper position, and directing the horses or cattle which draw it at the same time, is only to be acquired by experience; when once attained, it is, perhaps, the most agreeable and healthful of agricultural exercises, the body being kept upright, the arms and legs brought into action, and also the eye and the mind, to keep the furrow straight and of regular width and depth, and the voice to speak to the animals.

In the performance of this operation it is requisite,

First. That the lines traced by the plough should be perfectly straight and parallel with one another; the furrow slices all equal, and uniformly turned up, so that they may not overlap each other, or form any inequalities on the surface of the ground. If the slices are not of equal breadth, the operation becomes more difficult, because at every deviation from the straight line the resistance which the earth opposes to the instrument becomes increased.

Second. That the plough advance at a regular and uniform depth, and on a line parallel to the surface of the soil; that is to say, that it do not, as is the case when it is not well guided, sometimes cut thick and at others thin slices.

Third. That the plough empty the furrow as completely as possible, so that the earth may not fall in again, after the instrument has passed; and that the portion of soil not yet raised, but which has just been divided by the ploughshare, may form not an acute, but a right angle with the bottom of the furrow on which it borders.

Fourth. That the furrow-slice be turned up at an angle of about 40 degrees, or so as to form with the surface of the ground, or the bottom of the furrow, an angle of from 40 to 50 degrees, which is in most cases the best inclination.

Fifth. That the divided slices be always of the same breadth; and that it be such as is required by the nature of the soil itself, and the purpose of the operation.

Sixth. That they likewise preserve the depth which it is desirable to give them.

Seventh. That the ridges or heaps of earth between the furrows be of a suitable length and breadth, and that their sides be parallel to one another, so that they may not terminate in a point; for such a form tends to increase the labor of ploughing considerably, by rendering it necessary to turn frequently.

Eighth. That the ploughs be placed one after another, on different parts of the land to be ploughed, so that the operation may be executed in the best possible order, and with as little loss of time as possible.

Ninth. That the horses or cattle be harnessed as near to the plough as they can be placed without retarding their free and easy movement; for the nearer they are to the point of draught, the less exertion will be required to overcome the resistance.

Tenth. That when ploughing with a pair abreast, the most powerful horse should be worked in the furrow; but, if the team be harnessed in line, and there be any difference in the height of the cattle, the tallest should be put foremost, if he be in every respect equal to the other.

Eleventh. That, when at work, they should be kept going at as regular and good a pace as the nature of the work will permit; for they are thus more manageable, and the draught easier, than when slow. By attending to this, the heavy soil will cling less to the coulter, and the land will work more freely.

Twelfth. That, the breadth and depth of the furrow being ascertained, the plough should be held upright, bearing equally all along on a straight sole, and be made to move forward in a regular line, without swerving to either side. The edge of the coulter should be set directly forward, so that the land-side of it may run in a parallel line with the land-side of the head, and in such a position that their slant or sweep may exactly correspond.

Thirteenth. That the ploughman should walk with his body as nearly as possible upright, without leaning on the stilts, and without using force to any part, further than may be absolutely necessary to keep the implement steadily in a straight line. He should also be sparing of his voice, and of correction to the team: of the former, because too much cheering and ordering only confuse the cattle, and because punishment, when often repeated, at length loses its effect.

How to hold the Plough. — In ploughing, the instrument ought to be held vertically. If it is inclined to the left-hand side, the same work is performed in appearance, though not in reality, a portion of the ground below not being tilled at all, but left thus:

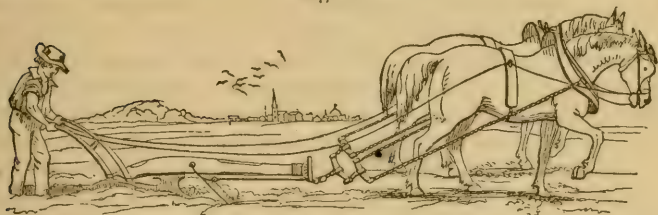
Fig. 12.



Construction of the Plough. — In the construction of ploughs, whatever be the sort used, there are a few general principles that ought invariably to be attended to; such as the giving the throat and breast — or that part which enters, perforates, and breaks up the ground — that sort of long, narrow, clean, tapering, sharpened form, that affords the least resistance in passing through the land; and to the mould-board that kind of hollowed out and twisted form, which not only tends to lessen friction, but also to con-

tribute greatly to the perfect turning over of the furrow-slice. The beam and muzzle should also be so contrived as that the moving power, or team,

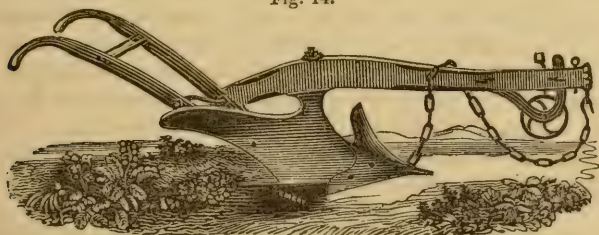
Fig. 13.



may be attached in the most advantageous line of draught. With such an instrument, the farmer can cultivate his land to advantage.

Depth of Ploughing. — This depends on the kind of crop to be cultivated, and other circumstances. In the field, all that can be arrived at is a kind of approximation to the true proportions. When the sods are considerably too wide in proportion to their depth, the ploughman will be admonished of this by their lying too flat, and too slightly overlapping one another. When their depth is considerably too great in proportion to their width, they will stand too upright, and be apt to fall back again into the furrow. The medium depth of good ploughing may be held to be seven inches, but this varies, according to the kind of crop to be cultivated, and the nature of the soil. The plough with lock coulter, wheel, and draft-rod, like the annexed, is most suitable for deep ploughing.

Fig. 14.



Ridges. — The first operation in the forming of ridges is *striking the furrows*. Let it be supposed that a field has been laid level by previous ploughings, and that the marks of former ridges being obliterated, the lines of the new ones are to be laid out. The usual breadth of ridges is from 15 to 18 feet, and sometimes more. We may assume, in the following descriptions, fifteen feet to be the width of the ridges.

Let a steady ploughman be furnished with three or more poles of wood, shod with iron, 8 or 9 feet in length, and divided into feet or half feet. The first operation is to mark off, at two sides of the field, what is termed a head-land. This is merely a ridge formed parallel to the side of the field, on which the horses are to turn; to afford sufficient space for which, these ridges may be 18 feet wide. The lines of them are marked off before the other ridges, in order that the ploughman may know, on arriving at the end of the ridge, when to turn his horses. After the rest of the field is ploughed, the headlands themselves are ploughed, and formed into ridges.

In the following diagram (Fig. 15), representing a field, let EF , GH , represent the lines of the headlands, drawn parallel to AB and CD , the sides or boundaries of the field, and at the distance from each of these sides of 18 feet. These lines the ploughman marks out by running a straight furrow with his plough, parallel to the two sides.

Let him now, beginning at the side of the field AD , parallel to which it is intended to run the ridges, measure off with his pole Ea , $7\frac{1}{2}$ feet. At the point a , let him place one of his poles. This is the point at which he is to enter his plough. But, leaving his horses, in the mean time, let him walk on to a convenient distance, as to i , and there, in like manner measuring off ib , $7\frac{1}{2}$ feet, let him set up his second pole at b ; and then, at the further end of the field, on the line of the headland, at c , let him place his third pole. He has now three poles placed in a line; but if, from the length of the field, or inequalities of the surface, more than three poles are necessary, more must be used, as there must be so many poles in sight as that the ploughman may be enabled to direct his plough, by means of them, in a straight line. He now returns to his plough, and enters it at the first pole, at a , keeping the other two poles in a line, so that he may be enabled to plough directly towards them. Having entered his plough at a , he stops his horses, and measures off 15 feet to d , where he plants the pole. He then returns to his plough, which is standing at a , and drives his horses, keeping the two poles before him as a guide, to the second pole, b . Having done this, and leaving his plough standing at b , he measures off from b to e , 15 feet, and there he plants his pole. He then returns to his plough, and proceeds forward, making his furrow in a straight line, to the last pole, c , where, in like manner, he stops his horses, and, measuring off 15 feet, he plants his pole at f .

In this manner he has placed his poles in a straight line, at the distance of 15 feet from their last position, and parallel, as before, to the line of the fence. He now turns his horses sharp about, and returns by the furrow which he has just drawn, cb a . By this second ploughing he throws the earth out in an opposite direction, so that he has formed a completely open

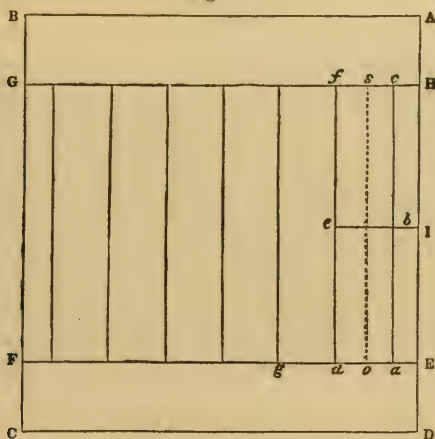
furrow. In returning, he takes care to correct any inequality or crookedness that may have taken place through the unsteady motion of the horses in his first track.

The poles being now placed in a line, *d e f*, he brings his plough to *d*, enters it, and stops it there. He measures off 15 feet with his pole, from *d* to *g*, and fixes his pole at *g*; and then he proceeds with his plough to *e* and *f*, repeating the same operation with his poles as before, and returning by the track of his last-made furrow, from *f* to *d*. In this manner he proceeds throughout the whole field, forming parallel open furrows, at the distance from each other of 15 feet. These furrows are to form the *centres* of the future ridges.

The field is now prepared for being ploughed into ridges, and the manner of doing so is this : —

The ploughman, beginning at the left-hand side of the open furrow, ploughs his first furrow-slice towards it. He then, returning by the opposite side, performs the same operation, causing the first two furrow-slices to rest upon each other. Thus, in forming his first ridge, he begins at the side of *a*, and, ploughing in the direction from *a* to *c*, he turns his first furrow-slice into the open furrow *ac*. When he arrives at *c*, he turns his plough right about, and returning from *c* to *a*, he lays his second furrow-slice upon the first one, as at *c*, Fig. 16.

Fig. 15.



In this manner he continues, always turning to the right-hand side, and laying his furrow-slices towards the centre of the ridge, until he has reached

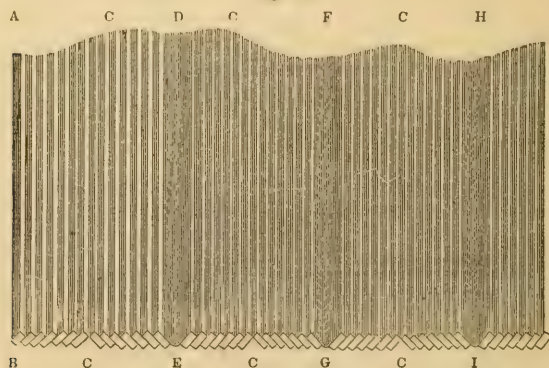
the boundary of the ridge EH , on the one side, and the line os , half-way between ca and df , on the other. He has thus formed a ridge, of which ca is the crown or centre, and HE and os the termination. By proceeding in this manner throughout the field, the whole is formed into ridges, of which the first-marked furrows are the centres.

It has been said that the ploughman continues turning his horses to the right, and that thus, after having proceeded from a to c , he returns from c to a , and so on, always ploughing around ac , as a central line. When, however, he has proceeded from a to c , he may turn his horses left about, and return from f to d , and so on, always laying his furrow-slices towards ac and fd , respectively. In this manner he will have ploughed the half of two adjoining ridges, and terminated at the space os , half-way between them. This method, it will appear, has the same effect as turning the horses right about, and is the most convenient in practice.

In Figure 16, in which cc, cc, cc , are the centres of the ridges, the manner in which the successive furrow-slices have been laid upon each other is shown.

By this laying of the earth towards the centres, the ridges acquire a certain curvature. By ploughing the earth away from the intervals AB, DE, FG, HI , the ground is hollowed at these parts, which now form the *open furrows*. It is by these open furrows that the water which falls upon the surface finds a passage.

Fig. 16.



A certain, though not a great, degree of curvature, is given to the ridge by this ploughing. It is frequently, however, necessary to give it a yet greater degree of curvature and elevation. This is done by ploughing the whole ridge a second time, and in a similar manner.

Gathering.—The plough is first driven along the centre of the ridge from c to c, forming an open furrow. Successive furrow-slices are then laid towards this furrow, in the same manner as in the previous ploughing. This is done with the successive furrow-slices, until the plough reaches the open furrows A B, D E, F G, H I. In this manner the whole ridge is ploughed, and an increased elevation and curvature given to it. This operation is termed *gathering*.

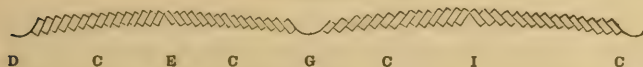
In performing the operation of gathering, it is important that the ridge be formed with a uniform curvature, so that it shall not have what is technically termed a shoulder, or hollow part, on each side of the crown. It is to prevent this defect that the open track is made along the crown, before the first two slices are laid together; by which means the ploughman is better enabled to lay them upon each other in such a manner that they shall not overlap and form a protuberance at the crown of the ridge. A transverse section of the ridges, when gathered, will appear thus :

Fig. 17.



Casting.—A ridge being already formed, it may be wished to plough it again, and yet to preserve it at the same curvature and elevation. In this case, the plough is to enter at the open furrow, and to lay the successive furrow-slices towards it, until the two adjoining edges are ploughed. By this means, all the slices of the same ridge lie in the same direction, and the curvature and elevation of the whole remain as before. This operation is termed *casting*, and the manner in which the furrow-slices rest upon each other will appear in the following cut.

Fig. 18.



In the operation of casting, two methods may be pursued. The first two furrow-slices, as those of E and I, may be laid resting on each other, as in Fig. 18, in which case the two ridges will be formed, as it were, into one large ridge; or else the open furrows at E and I may be preserved by keeping the first two furrow-slices at a little distance from each other, and preserving the space between them, as in Fig. 19.

When land is ploughed in this manner, the ground is taken from one side of each two adjoining ridges at c, and laid towards the other, E and I; that is, it is gathered towards one side and gathered from the other. In

this manner, the ground at the open furrow G, from which we gather, becomes more bare of earth than the open furrows E and I, towards which

Fig. 19.



we gather. When, therefore, we wish to cast a ridge twice in succession, we reverse the former mode of ploughing; we gather towards the open furrow G, and from the open furrows E and I, and thus the ridge is restored to its former state.

Clearing. — In this operation, the plough commences at the open furrow, lays the first slice towards it, and then returning by the other side of the open furrow, lays the second slice upon the first, as in the following figure. When it has reached the centre, it stops, and begins with another pair of ridges, and ploughs the half of each pair together in the same manner. In this way the open furrows of the ridges become the centres, and the former centres become the open furrows. When we wish to level a ridge, we cleave it.

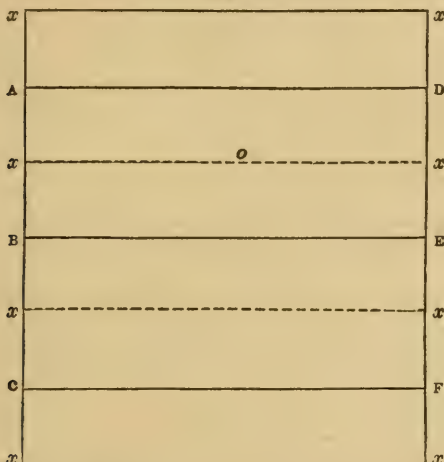
Fig. 20.



Cross Ploughing. — This, as the term denotes, is ploughing in a direction crossing that of the former ridges and furrows. The workmen place themselves at equal distances from one another, as thirty or forty yards, at the side of the field at which they are to begin to plough. Each then runs a straight furrow across the field, as from A to D, from B to E, from C to F. Each then returns, as from D to A, from E to B, from F to C, laying always the successive furrow-slices towards the right hand, until each man arrives at the termination of his allotted space, *xx, xx, xx, xx*. There has been thus formed, by each workman, one great ridge, but so extended that it may be said to be without curvature. The ploughmen, we perceive, turn from left to right, around the first furrows A D, B E, C F. But they may also turn from right to left. Thus, in going from B to E, the ploughman lays his first furrow-slice to the right hand. When he arrives at E, he may turn his horses left about, and proceed to D, and, returning from D to A, lay his first furrow-slice to the right hand towards D A. Turning left about, then, at A, he proceeds in the direction B E, and so on, always turning left about until he has arrived at the middle space o, when the whole space between A D and B E will have been ploughed. Sometimes, for conven-

ience and the saving of distance, he may plough, in the first place, around the central line $B E$, by turning from left to right, and then plough the remainder of the interval by turning from right to left.

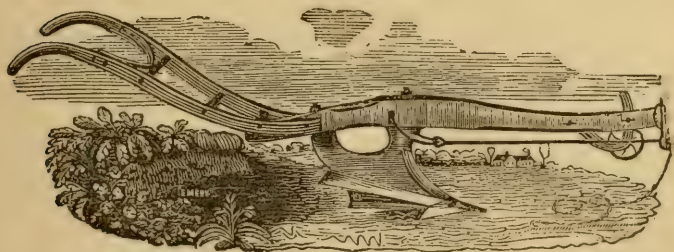
Fig. 21.



These are matters of detail, somewhat difficult, perhaps, to be described clearly, but so simple in themselves, that they need only be seen in the field to be thoroughly understood.

Subsoil Ploughing. — Loosening the subsoil by a plough, without turning

Fig. 22.



it, has been strongly recommended, of late years, as a great improvement in tillage. A heavy plough is first run along the field some six or eight inches deep, and a subsoil plough (see Fig. 22) follows in the bottom of the

furrow, deepening it to fourteen or sixteen inches in all. This differs from trench ploughing, in which the subsoil is cast up and mixed with the surface, by which the soil is either benefited or injured, according to the nature of the subsoil. The principal effect of subsoil ploughing is, that the earth is deepened to a considerable depth, and root culture is much improved; the soil is also considerably drained, and if moor-pans exist in it, may be reclaimed from sterility. It is, therefore, a useful process in stiff soil-imperfectly drained, but, in loose gravelly or sandy soils, subsoil ploughing is often very injurious.

Fallowing. — In support of fallowing, it has been urged, that by no other management has land produced so much corn — so much *human* food, which ought to be the great object; that the work required in the operation is at a time of year when no pressing demand for labor exists, when there is often little or nothing for men or horses to execute; that the land can be effectually prepared for an early sowing of wheat, which is very desirable; and that if fallowing (we now refer to complete summer fallows) were to be superseded by spring or early green crops, a greater number of teams on any given extent of farm would be required to get through the work in proper season; and that the transition from this practice, where it is regularly established, would be highly inconvenient.

Fallows are of two kinds, — the entire or naked fallow, and the half fallow. In proportion to the progress of green-crop culture will be the relinquishment of the system of entire summer fallowing, which, after a farm has been once put into proper order, and with a regular rotation of ameliorating and cleansing crops, alternating with grain crops, is quite unnecessary. Unless on the first occupation of an exhausted and dirty farm, and without the means of manuring for fallow crops, the system of an entire summer fallowing is indefensible. Even on the strongest clay land, good, deep, and very early autumnal ploughing, with the subsequent spring culture well executed, and manure, ought to be sufficient for the production of crops. If the soil be of too tenacious a quality for turnips, it will yield potatoes, beans, or cabbages, and the horse-hoeing process will render it friable, and fit for the ensuing crop of wheat.

The full benefit of fallowing lies in loosening the adhesive particles of soil, and in the admission of air, so essential to vegetation; in suppressing, for a season, the productive powers and energies of the earth, and in destroying the vitality of weeds, and dissolving them altogether, by exposure to the influence of the sun and atmosphere; but all these effects may be produced by half-fallowing and green-crop culture. On friable soil there is no excuse for the former kind of fallowing, whatever may be urged in favor of the practice on strong chalky or clayey land. The number of ploughings and

harrowings must be regulated by the nature of the soil. Four good ploughings, (exclusive of the first in the preceding autumn,) and as many harrowings, ought to suffice for the most stubborn soils. If a fallow crop — suppose turnips — is to be put into the ground, three summer ploughings ought to suffice.

Why is it that one good, thick-standing crop is always followed by another? Why is lea-wheat better if the clover has been mowed twice than if it had been depastured? Why is land found to be in better heart after a heavy green crop than it is after bearing a white crop? The answer to all these questions is the same, namely, the soil has been completely shaded from the summer's sun. If a heap of stones be suffered to lie on a fallow field throughout the summer, and be not removed till seed-time, the spot will not only be visible by a much stronger growth of corn in the first, but for several years afterwards. Add to this what was said by an agricultural philosopher, that if he could cover his fallow fields for the whole summer with boards, his next crop would be doubled. But there are many circumstances which may affect the surface of some soils differently from others. A thick crop of tares or of clover makes the surface moist and mellow when ploughed up, and thus may be beneficial to the seed sown immediately; but there is a certain benefit to a heavy soil, arising from exposure to the dews and a warm sun, which cannot be denied, and which often equals a coat of manure.

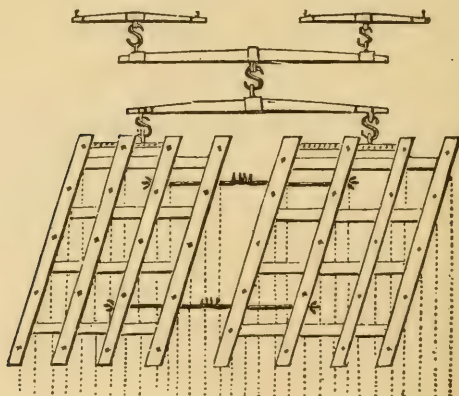
In all cases of fallow, the first ploughing should be given immediately after harvest, and as deep as the quality of the soil will permit, with a strong team, if the land be very stiff and retentive of water; and in all cases the field should be well ridged and deeply furrowed. Immediately after the stirring time of spring-work is over, if fallow crops are to be sown, the second ploughing is to take place, and in the same direction with the former one, lest, by cross-ploughing, a fall of rain should stagnate on the surface; but in light soils a cross-ploughing is preferable, even at this early time. The third ploughing should be executed in June, and at this time always across the original direction of the ridges; harrowing with a heavy break, if the land require it, should regularly succeed the summer ploughing, (with rolling, if necessary,) and the harrowing is to be executed by repeated double turns, crossing those of the previous ones, until the land is sufficiently pulverized to admit of the easy collection of weeds, with the harrow, the couch-rake, or prongs.

It is of great importance, at this period of the summer-fallow, to drag to the surface and collect as large a portion as possible of the roots of vivacious weeds in the ground; for this being the period of active vegetation, every

part of these roots which is left in the ground will grow again and extend itself.

4. HARROWING. — In conducting this operation, the harrows pass over the ridge either longitudinally or across. At the end of the ridge they are

Fig. 23.



turned, and generally pass again over the same ground. This is called a double turn of the harrows. When they do not return over the same ground, but pass to another space, they are said to give a single turn. When land is to be pulverized and cleaned of root-weeds, the operation consists of repeated double turns of the harrows in different directions. The root-weeds, being dragged to the surface, are collected by the hand, and carried off the ground or burned. The plough prepares the ground for the action of the harrow, and the plough and the harrow acting by turns, the land is pulverized and cleaned.

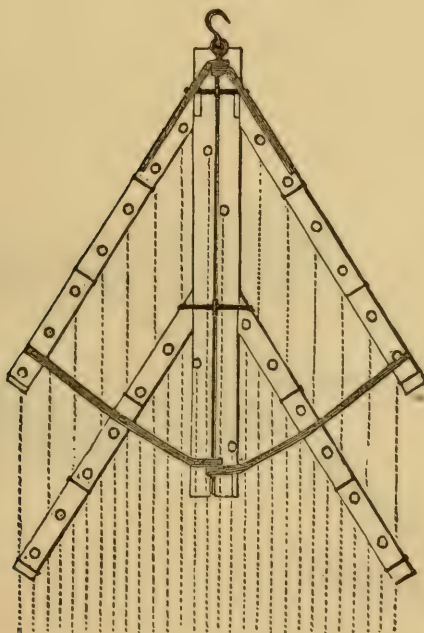
Besides the cleaning of the ground, a purpose in harrowing is to cover the seeds of the cultivated plants. The number of harrowings to be given for this end depends on the state of the ground and other circumstances. When the surface is matted together by the roots of plants, as in the case of land ploughed when in grass, repeated double turns are required to cover the seeds in a proper manner.

The operation of harrowing is best performed when the land is dry. Harrowing when the land is wet is to be avoided, both on account of the less efficiency of the operation, and of the injury done to the ground by the

treading of the cattle. In the case of covering seeds, however, in unfavorable seasons, it is often necessary to harrow the ground when in a wet state. In extreme cases of this kind, the practice has been sometimes resorted to of attaching several harrows to a beam stretching across the ridge, and causing the animals to walk in the open furrows.

There are several kinds of harrows in use ; but the Geddes pattern, represented below, is, by many, considered superior. The Scotch harrow is exhibited in the cut immediately preceding the one below.

Fig. 24.

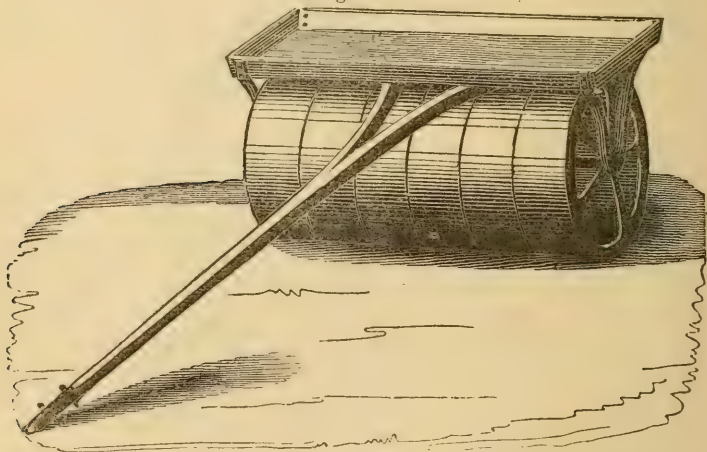


5. ROLLING. — This operation, which, however, should not be attempted when the land is so wet as to clog the roller, is highly conducive to the vegetation of crops — especially wheat — by reducing the rough parts of the surface to a mouldered state, and thus earthing up the stems of the plants while it renders the surface level and compact. Its use, in closely compressing the particles of earth on light, sandy soils, by excluding cold wind or a parching sun from the roots of young corn, is extremely great, and may be

repeatedly performed to grain crops in the spring months, as long as it can be continued without breaking the stems. A heavy roller is essential to the success of corn in tenacious soils, by closing up the fissures which dry weather occasions, and is useful for breaking down clods on fallows, in aid of the harrow, which then more easily separates them, and disengages weeds, bringing them to the surface.

If the roller be heavy, — as it ought to be, in order to be really useful, — and require two horses, they should not be in line, unless the roller be constructed with only single shafts; independently of the disadvantageous application of power in this case, the trampling of eight legs, instead of four, in the same track, will make, under particular circumstances, impressions which the roller will not so readily remove as if only the footsteps of a single horse in the track were imbedded. This is, of course, perfectly immaterial in preparing fallows for the succeeding plough and harrow, though it may be of some weight in the case of sown crops, where the surface is not to be stirred again.

Fig. 25.



On grass lands heavy rolling is highly efficacious, particularly if the surface has been rendered uneven by the treading of cattle, or by any other causes. On dry, absorbent land, when under grass, rolling will be most useful after rain, if not so immoderate as to cause injury from the feet of the animals during the process; and the earlier in the morning the better, in order to destroy vermin. Meadows are served by rolling immediately after the hay is removed, in order to press the seeds that had been diffused over

the surface into the earth, and thus promote their vegetation. The usual way of moving the roller, is to begin at one end of the field, and to leave at each bouting an interval precisely of the breadth of the roller, (in order to allow a sufficient sweep for the roller in each turning, without injuring the head-rig by tearing it, or distressing the horses,) and alternately to roll these intervening portions. When the land is in ridges, the rolling should be across them.

The box which is seen attached to the roller represented on the preceding page, is to receive stones, &c., picked up in the field, and also for giving weight to the roller according to the work required.

6. MANURING. — This important subject will be treated of in its relation to the composition of manures and their application to the different soils.

Action of Manures. — Manure acts upon the soil in two ways: First, by communicating to it those juices which are calculated for the nutrition of plants and vegetables; and, secondly, by the chemical action which it exercises on those substances contained in the soil, decomposing them, and re-combining them under new forms, and thus facilitating their introduction into the suckers of plants; and, perhaps, also by communicating that degree of energy and activity to vegetation, which enables it to take up and appropriate the suitable nutritive juices.

Natural Manures. — All animal bodies, as dead carcasses, flesh, intestines, the refuse of the shambles, &c., when in a state of putrefaction, may be converted into manure; and manures thus formed are far more active than any other. Yet, in general, the excrements and urine of animals, obtained from them while living, are set aside for manure, because a large quantity can thus be procured, and at much less cost. It is found very advantageous to mix these excrementitious substances with the remains of vegetable matters, for by this means the latter are made to putrefy more rapidly, and do not lose so much of their actual substance, while, also, the fermentation of the animal bodies, which would otherwise be carried on with too great rapidity, is somewhat retarded. Manures thus formed are called “natural manures,” in order to distinguish them from others which are termed “artificial.” Besides, they are the kind best known, and, indeed, among many persons, are the only description which is known and used.

Those excrements which are voided by animals through the intestinal canal are composed not only of the food which they have taken, and of that portion of its filaments which could not be decomposed, but also of minute particles of the body of the animal itself, which are deposited in the intestinal canal after having performed their office. They consequently may be said to be entirely composed of animalized substances, and, even in animals fed almost entirely on vegetables, will be found to possess more of

the animal than the vegetable nature. The properties of the dung, however depend, to a certain extent, on the manner in which the beasts are fed, and their condition and breed. Hence arises the striking difference which exists between the dung yielded by cattle put up to fatten, or which are in a good state of keeping, and that which is voided by lean, badly-fed animals.

Urine. — It is generally customary to mix urine with the solid excrements. This liquid, which is, in fact, composed chiefly of water, likewise contains a substance which is peculiar to itself, and various other very active matters, particularly ammonia. These matters are most beneficial when mixed up with the solid excrements, and collected by means of litter, or of substances peculiarly adapted for the purpose, which substances decompose one another, and give rise to the formation of new compounds. Common manure is composed of these two kinds of excrements, and of those vegetable substances which are used as litter, as straw, fern, or dry leaves,—chiefly the first of these three. This mixture is commonly termed stable-manure.

The Various Kinds of Excrement. — When horse-dung, in a proper state of moisture, is exposed to air of a moderate temperature, it soon enters into fermentation; and if it is not watered, instead of assuming the form of a thick paste or black-butter, as it is called, it becomes powdery, and wastes away, leaving scarcely anything but ashes behind. Manure produced by horn-cattle also begins to ferment very soon, provided that it is close and uniform in consistence, and contains only its proper moisture; but its fermentation is less rapid than that of horse-dung, and, therefore, requires no watering, and does not waste away. Its effect on land is also more lasting, though less rapid. When placed in the soil, it does not appear to produce any very sensible increase of the temperature, and on this account it is adapted peculiarly for the manuring of warm soils. Sheep-dung, when kept in a compact heap, decomposes rapidly; but where it is loosely heaped, it decomposes much more slowly. When placed in the soil, or dropped upon it by the sheep, it produces a speedy and energetic effect, oftentimes giving too much vigor to the first crop, when it is used abundantly. The quality of pigs'-dung depends greatly on the kind of food they consume, also on the manner of collecting it. If the liquid portion of the excrements are mixed with the straw in such a manner as to prevent any running off, and the dung is placed in a situation favorable to its decomposition, a very active compound is produced. Poultry-dung can be obtained generally only in small quantities, but it is very active, and of great value. It is very different from that of quadrupeds, and contains a peculiar substance, mainly resembling the white of an egg. This kind of manure, in order to have its due effect on the soil, must be divided as minutely as possible, and be spread over the ground, without burying or covering it up.

Night-Soil. — Human excrements, or night-soil, make a very active manure. The best way of using it is to form it into a kind of compost, by mixing it with other substances, and especially by making it into heaps with turf, and adding a small quantity of burnt lime. By mixing and mingling it thoroughly with these substances, it loses its fetid odor, and should then be spread over the ground, without covering or burying. A powerful manure is manufactured from night-soil, called *poudrette*, on account of its form being that of a powder.

Management of Manures. — Dung should be left in the stable as long as possible, for its quality is thereby improved. But it should not be done at

Fig. 26.



Fig. 27.



the expense of the cleanliness and comfort of the cattle, or keeping the stable dry. If the dung is suffered to remain under the cattle, great care must be taken that it does not collect in larger quantities under their hind than under their fore feet, for that would keep them in an unnatural attitude.

In ordinary circumstances, it is more convenient to mingle the different species of dung uniformly in the heap, so that the defects of one sort of manure may correct those of another ; and the result will be a regular and well-digested compound.

As to the time when manure should be carted into the fields, and the state in which the manure should be, it is pretty well ascertained that manure should not be removed whilst in a high state of fermentation, because at that

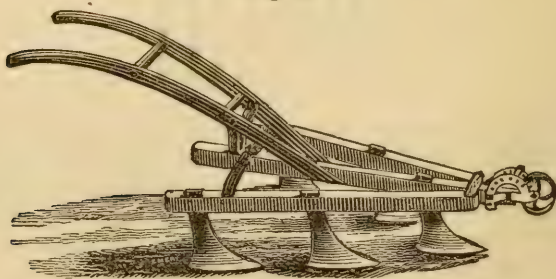
period an important part of some of its most active properties would evaporate; but before fermentation has commenced, or after it has subsided, it appears to lose little by exposure to air, beyond what it regains in another manner.

There are visible advantages attending the spreading upon the land fresh strawy manure, and to leave it till the ploughings of spring commence, taking care, however, that the water does not wash away the juices, and carry them beyond the field, but that it merely allows them to penetrate the earth. This method of covering the soil during winter renders it much more friable, and remarkably fertile.

The practice of leaving the manure on the land in small heaps, as it is unloaded from the carts, is not judicious. The decomposition will be very irregular, the valuable gases will be carried away by the wind, the most valuable portion of the juices will all be absorbed by the soil immediately beneath the heap, and the places where these heaps have been will be marked by the rank growth of the crop, whilst the surrounding parts present an impoverished appearance.

The proper time for carting manure varies much with the circumstances and economy of the farm. Winter manure is best suited for seed crops, whilst fresh litter is particularly adapted to potatoes, especially in clay soils, because it diminishes their tenacity, and allows the plant to come in contact with the atmosphere. Other crops, and especially cabbages, do better with decomposed manures; this being, on light lands, essential to their success. Afterwards, the manure for beans and peas may be carted, and this can

Fig. 28.



either be buried or spread over the soil. To heavy clay lands a larger portion of manure must be given at a time, because they can bear it without risk of the crops being laid. Upon a light, hot soil, the manure is quickly decomposed, and a very abundant supply may have a bad effect, in causing

the crops either to fall or to scorch up. In mixing fine manures with the soil, the improved expanding cultivator (Fig. 28) is very useful.

Forming Composts.—In the formation of composts, two methods are pursued. In the one, the several matters of which they are composed are divided into different layers, and placed one above the other; at the bottom of the heap a bed of turf or of earth is placed, five or six feet larger on each side than the extended heap; then a layer, about a foot thick, of the freshest dung that is to be had; above this another layer of turf or earth. If there are any other matters capable of putrefaction, they are placed upon this bed, which is covered with another layer of dung, and so on, till it has arrived at a height of five or six feet; it is then covered with another layer of earth. Quick-lime is often mixed with these composts, but the lime must not be in immediate contact with the dung, because it causes it to decompose too speedily and to too great an extent. Place it between two layers of earth, or between earth and any other substance difficult of decomposition. When the sides of the bed of the dung-hill have become saturated with the liquor from the heaps, they are turned over and spread upon the surface. The compost then heats, and fermentation commences, and it is left till this fermentation ceases. When no more heat is felt in the interior of the heap, it is turned over, so that the part which was above becomes the bottom, and that which formed the sides is turned into the middle. Sometimes a fresh bed of earth is placed below the heap. The heap, when turned over, is long and narrow, resembling a roof, in order that it may be more exposed to the air; because it is thought that by this means it is increased in weight and quality.

In the other method which is pursued in forming composts, the various substances are all brought to the place where the dunghill is to be made, and are deposited separately around it. The bed of earth for the bottom of the heap is then formed in the middle; the laborers then surround the heap, and each, with a shovel, throws the substances as they lie around it into the bed, by which means the whole mass is equally mixed throughout. Thus loam, earth, tufts of grass, moss, the leaves of trees, particularly of pine trees, saw-dust, and the remains of animal or vegetable matter, and very often, in addition to this, lime, ashes, soot, and fresh litter, are all incorporated, and the mixture wetted with the liquid which drains from the manure, or with urine. This dunghill should, like the former, be allowed to remain quiet till the fermentation is past, when it should be turned over several times.

Litter.—Where there is a scarcity of straw, various vegetable substances are used for the purpose of absorbing and retaining the excrementitious matters, and forming a dry bed for the cattle, as well as for increasing the

quantity of the manure. The litter in most general use, after straw, is the leaves of trees, especially the pine; and when once the decomposition has taken place, the dung is even superior in quality, because the pine-tree leaves contain a far greater proportion of nutritive juices than the straw. Oak-leaves are not so good, and when mixed with manure before they are decomposed, must not be removed from the heap for a considerable period. The leaves of beech, walnut, and chestnut trees are apparently not greatly beneficial to vegetation, since little or no grass usually grows under them, but, when mixed with dung, they soon lose their baneful properties, and rapidly decompose. Alder, willow, and poplar leaves decompose quickly, but they possess little consistence, and tend only slightly to increase the volume of the excrements which they receive. Heath, broom, reeds, rushes, aquatic plants, moss, fern, &c., may be used as litter, when nothing else can be obtained.

Applying Liquid Manure. — The liquid manures, which should be carefully attended to, are specially devoted to those crops which will bear rich ameliorations. Some farmers reserve them for clovers and other artificial meadows, or for natural pastures. They are never so advantageous as when applied to sandy soils, which they render tolerably consistent, and more adapted for the retention of moisture; but the use of liquid manure will never replace that of dung on hard or clayey soils.

Folding. — Besides the various animal manures which we have named, there is that which arises from the folding or coting of sheep or cattle on arable land. This practice is most usually followed with sheep. It is questionable, however, whether this close confinement of sheep be favorable to their health and fleece. It is only the strongest and most vigorous breeds that can support it. And, independently of the difference in the health of animals, folding at night in common, littered, combines all the advantages of folding on arable land, with this exception, that the latter method saves the labor and expense of carrying the manure.

Dead Bodies, Bones, &c. — Animal bodies, when dead, form a peculiarly active manure. If these are collected together in trenches, or enclosures walled around, covered with quick-lime, mixed with earth, and subsequently, when they have lost their putrid and offensive smell, which is soon carried off by the lime, the whole mixture be stirred and mingled together, an exceedingly active manure will be obtained. Even bones are softened by the admixture of quick-lime, and when powdered and applied to land, produce a wonderful effect. Fish, covered with lime and mixed with earth, are very fertilizing. Horn, hoofs of animals, shamble refuse, hair and wool, sugar scum, and all kinds of filth, are good for manuring. Guano, which consists simply of the excrement of sea-fowls, is

also a powerful manure, but must be applied more abundantly than is commonly supposed, in order to be effective. It should not be applied in immediate contact with seeds, requires considerable moisture, and, if well mixed with three or four times its weight of finely sifted earth, and suffered to remain some weeks in this state before it is used by the drill, or applied broadcast, its effects will be more considerable.

Vegetable Manures. — Purely vegetable manures are not nearly so active and energetic as those of animal origin ; but, on the other hand, their effects are more durable. There cannot be a doubt that all those weeds which are allowed to produce their flowers, and then buried by the action of the plough, tend to augment the fertility of the soil. There is not a single vegetable substance, even down to the stubble which most crops leave behind them, which does not restore some portion of mould to the soil ; and nothing tends to improve land more than the turf or accumulation of herbage which is successively formed during a number of years. Those plants, however, which are cultivated for the purpose of being buried as vegetable manure, should be such as will shoot up and flourish with all possible rapidity. The seed must not be expensive ; but of such a nature as that a small quantity will sow a considerable surface, — must be well adapted to keep the soil loose, and must be disposed to putrescence. There is no plant which combines these qualities so largely as what is called corn spurry ; also rape peas, vetches, beans, and buckwheat. Sea-weeds and pond-weeds may likewise be entered in the class of vegetable substances which yield an active and energetic manure ; also the weed which is found at the bottom of rivers, ponds, and other places in which stagnant water has remained for any length of time. Peat is a substance which may also be employed for the amelioration of land, especially light, friable soils.

Mineral Manures. — Of late years there has been considerable discussion concerning lime as a manure. This substance, especially when it has been recently calcined, or is, in other words, what we call quick-lime, absorbs the carbonic acid which is contained in the atmosphere which surrounds it, and afterwards communicating it to the plants, doubtless furnishes them with some nourishment : but this nutrition is very slight ; the property to which it owes the chief power in promoting vegetation is that of decomposing the various inert vegetable or animal substances which it meets with in the soil, and transforming them into nutritive juices adapted to the nature of plants.

The use of marl is always attended by evident and beneficial effects, especially when clayey marl is applied to a sandy soil ; and advantageous results have been obtained even when, after several years of rest, the land has appeared so exhausted and sterile as scarcely to be worth the trouble of

sowing it. It is likewise advantageous to make use of marl mixed with dung, and with peat and mud, in the form of a compost.

The effects of gypsum are much greater on dry soils than on those which are moist or damp. It is chiefly used in the cultivation of clover, or other plants of a similar nature. It is applied both in a calcined and an uncalcined state, without much difference in its effects, unless, indeed, a heavy rain falls immediately after this substance has been spread in the former state, when the powder will be converted into hard, strong lumps, and rendered useless. The most important point is to see that the gypsum is powdered as fine as possible, and strew it when there is but little wind.

Ashes, of various kinds, are much used, especially abroad. When thoroughly burned, ashes are composed of earths and potash, to which are sometimes added metallic oxides and different salts. Lime is always the predominating earth which enters into their composition, even when the plants whence they are derived have not sprung from a limy soil. Bleachers' and soap-boilers' ashes are much preferred.

7. DRAINING. — As a certain quantity of moisture is essential to vegetation, so an excess of it is highly detrimental. In the removal of this excess consists the operation of draining.

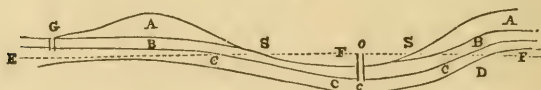
The Causes of Wetness in Lands. — The successful practice of draining depends, in a great measure, on a proper knowledge of the structure of the earth's upper crust; that is, of the various layers of which it is composed, as well as of their relative degrees of porosity, or capability of admitting or rejecting the passage of water through them, and likewise the modes in which the water is formed, and conducted from the high or hilly situations to the low or level grounds. To perform properly the business of draining, attention should not only be paid to the differences in regard to the situation of the lands, or what is commonly called drainage land, but also to the nature, distribution, and depth of the materials that constitute the soils or more superficial parts of them, as upon each of these some variety, in respect to the effects arising from water retained in them, may depend. Wetness of land, so far as it respects agriculture, and is an object of draining, may generally depend on the two following causes: first, on the water which is formed and collected on or in the hills or higher grounds, filtrating and sliding down among some of the different beds of porous materials that lie immediately upon the hard strata or layers, forming springs below and flowing over the surface, or stagnating underneath it, — and, secondly, on rain or other water becoming stagnant on the surface, from the retentive nature of the soil or surface materials, and the particular nature of the situation of the ground. The particular wetness which shows itself in different situations, in the forms of bogs, swamps, and morasses, for the most part

proceeds from the first of these causes; but that superficial wetness which takes place in the stiff, tenacious, clayey soils, with little inclination of surface, generally originates from the latter. The most certain and expeditious method of draining, in such cases, is that of intercepting the descent of the water or spring, and thereby totally removing the cause of wetness. This may be done where the depth of the surface, and consequently of the spring, is not great, by making level drains of considerable length across the declivities of the hills, about where the low grounds of the valleys begin to form, and connecting these with others made for the purpose of conveying the water thus collected into the brooks or rivulets that may be near. Where the spring has naturally formed itself an outlet, it may frequently only be necessary to bore into it, or render it larger, and of more depth, which, by affording the water a more free and open passage, may evacuate and bring it off more quickly, or sink it to a level so greatly below that of the surface of the soil as to prevent it from flowing into or over it.

Boggy Lands, and the True Line of the Spring. — In the drainage of boggy or wet grounds, arising from springs of water beneath them, it is necessary to be fully acquainted with the nature and disposition of the strata composing the higher grounds, and the connection which they have with that which is to be rendered dry. The line of springs being ascertained, and also some knowledge of the under surface, a line of drain should be marked out above or below them, according to the nature of the strata, and excavated to such a depth as will intercept the water in the porous strata before it rises to the surface. The effect of such drains will often be greatly heightened by boring holes in their bottom with the auger. Where water issues forth on the surface at more places than one, it is necessary to determine which is the real or principal spring, and that from which the other outlets are fed, as by removing the source, the others must of course be rendered dry. It may sometimes happen that where the highest are the strongest outlets, they may be the main or leading springs; those which show themselves lower down in the land being merely formed by the water of the main spring overflowing, and finding itself a passage from an opening, or the porous nature of the materials of the soil near to the surface, and from being obstructed somewhat further down in the ground by some impenetrable layer. This circumstance must, therefore, be fully ascertained before the lines for the ditches or drains are marked out. In cases where the banks or rising grounds are formed in an irregular manner, and from the nature of the situation, or the force of the water underneath, springs abound around the bases of the protuberances, the ditches made for the purpose of draining should always be carried up to a much higher level in the side of the elevated ground than that in which the wetness or water appears; as far even as to

the firm, unchanged land. Where there is a difficulty in ascertaining the line of the spring, and consequently that of the cross drain, either from its not showing itself upon the surface, or from there not being any apparent outlet, it may generally be met with in carrying up the conducting drain for conveying away the water; as soon as the operator discovers the spring, he need not proceed any further, but form the cross drain on the level thus discovered to such a distance on each side of the tail, or terminating part of the strata, of whatever sort, that contains the water, as the nature of the land, its regard to situation or other circumstances, may demand. The following figure, representing an uneven surface, will illustrate the nature of the strata which produce springs.

Fig. 29.



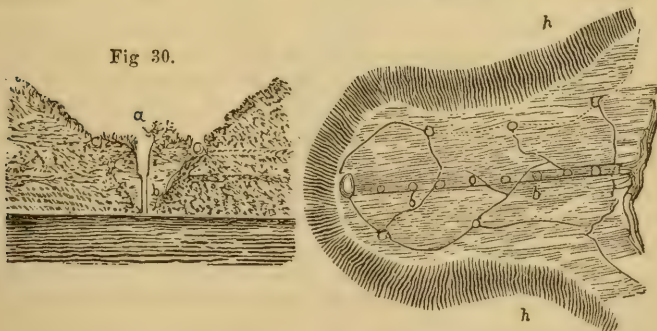
Suppose A A a porous gravel, through which the water filtrates readily, B B a stratum of loam or clay, impervious to water. The water which comes through A A will run along the surface of B B towards s s, where it will spring to the surface, and form a lake or bog between s and s. Suppose another gravelly or pervious stratum under the last, as c c c, bending as here represented, and filled with water running into it from a higher level; it is evident that this stratum will be saturated with water up to the dotted line E F F, which is the level of the point in the lower rock, or impervious stratum, D, where the water can run over it. If the stratum B B has any crevices in it below the dotted line, the water will rise through these to the surface, and form springs rising from the bottom of the lake or bog; and if B B were bored through and a pipe inserted, rising up to the dotted line, as c o, the water would rise and stand at o. If there were no springs at s s, the space below the dotted line might still be filled with water rising from stratum c c c. But if the boring took place at g, the water would not rise, but, on the contrary, if there were any on the surface, it would be carried down to the porous stratum c c c, and run off. Thus in one situation boring will bring water, and in another it will take it off. This principle being well understood, will greatly facilitate all drainings of springs. Wherever water springs, there must be a pervious and an impervious stratum to cause it, and the water either runs over the impervious surface, or rises through the crevices in it. When the line of the springs is found, as at s s, the obvious remedy is to cut a channel with a sufficient declivity to take off the water in a direction across this line, and

sunk through the porous soil at the surface into the lower impervious earth. The place for this channel is where the porous soil is the shallowest above the breaking out, so as to require the least depth of drain ; but the solid stratum must be reached, or the draining will be imperfect. It was by attending to all these circumstances that Elkington acquired his celebrity in draining, and that he has been regarded as the father of the system.

Drains, and Peat Lands. — When the drains cannot be carried to a sufficient depth to take the water out of the porous stratum saturated with it, it is often useful to bore numerous holes with a proper auger in the bottom of the drain through the stiffer soil, and, according to the principle explained in the preceding figure, the water will either rise through these bores into the drains, and be carried off, and the natural springs will be dried up, or it will sink down through them as at *c*, in the section, if it lies above. This method is often advantageous in the draining of peat-bogs, which generally lie on clay or stiff loam, with a layer of gravel between the loam and the peat, the whole lying in a basin or hollow, and often on a declivity. The peat, though it retains water, is not pervious, and drains may be cut into it which will hold water. When the drains are four or five feet deep, and the peat is much deeper, holes are bored down to the clay below, and the water is pressed up through these holes, by the weight of the whole body of peat, into the drains, by which it is carried off. Figures 30 and 31, represent a common case of this kind ; *h h* (Fig. 31) are the sides of a hill ; the swampy lot, below, is filled with springs, which are, however, drained by running a ditch (*b b*) across it, and sinking

Fig. 31.

Fig 30.



holes into the subsoil. One of these holes is seen in Fig. 30 (*a b*), and the manner in which it conveys the surface water away. The bottom of the

drains is sometimes choked with loose sand, which flows up with the water, and they require to be cleared repeatedly ; but this soon ceases after the first rush is past, and the water rises slowly and regularly. The surface of the peat, being dried, dressed with lime, and consolidated with earth and gravel, soon becomes productive.

When a single large and deep drain will produce the desired effect, it is much better than when there are several smaller, as large drains are more easily kept open, and last longer, than smaller ones ; but this is only the case in tapping main springs, for, if the water is diffused through the surrounding soil, numerous small drains are more effective. But, as soon as there is a sufficient body of water collected, the smaller drains should run into larger, and these into main drains, which should all, as far as is practicable, unite into one principal outlet, by which means there will be less chance of their being choked up. When the water springs into a drain from below, it is best to fill up that part of the drain which lies above the stones, or other materials which form the channel, with solid earth well pressed in, and made impervious to within a few inches of the bottom of the furrows in ploughed land, or the sod in pastures ; because the water running along the surface is apt to carry loose earth with it, and choke the drains. When the water comes in by the sides of the drains, loose stones, or gravel, or any porous material, should be laid in them to the line where the water comes in, and a little above it, over which the earth may be rammed in tight, so as to allow the horses to walk over the drain without sinking in.

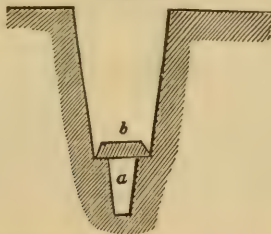
Hard Soils. — Another branch in the art of draining is the removal of water from hard soils which lie flat, or in hollows, where the water from rain, snow, or dews, which cannot sink into the soil, runs along the surface and stagnates in every cavity or depression. In this case a number of drains are required to lay the surface dry. There is often a layer of light earth immediately over a sub-layer of clay, and after continued rains this soil becomes filled with water, like a sponge, and no healthy vegetation can take place. To meet this, numerous drains must be made in the subsoil, and even the draining tiles or bushes, which may be laid at the bottom of the drains ; loose gravel or broken stones must be laid to within a foot of the surface, so that the plough shall not reach them. The water will gradually sink into these drains and be carried off, and the loose wet soil will become firm and dry.

Direction of Drains. — It is very seldom that a field is absolutely level ; the first thing, therefore, to be ascertained, is the greatest inclination, and its direction. The next object is to arrange drains so that each shall collect as much of the water in the soil as possible. Large drains, except as main drains, are inadmissible. The depth should be such only that the plough may

not reach it, if the land is arable, or the feet of cattle tread it in, if it be in pasture. All the drains which are to collect the water should lie as nearly at right angles to the inclination of the surface as is consistent with a sufficient fall in the drain to make them run. One foot is sufficient fall for a drain three hundred feet in length, provided the drains be not more than twenty feet apart. The main drains, by being laid obliquely, across the fall of the ground, will help to take off a part of the surface water. It is evident that the drains can seldom be in a straight line, unless the ground be perfectly even. They should, however, never have sudden turns, but be bent gradually where the direction is changed. The flatter the surface and the stiffer the soil, the greater number of drains will be required. It is a common practice with drainers to run a main drain directly down the slope, however rapid, and to carry smaller drains into this alternately on the right and left, which they call herring-bone fashion. But this can only be approved of where the ground is nearly level, and where there is very little fall for the main drain. A considerable fall is to be avoided as much as possible, and every drain should lie obliquely to the natural run of the water. It generally happens that, besides surface water, there are also some land springs arising from a variation in the soil ; these should be carefully ascertained, and the drains should be so laid as to cut them off.

Clay Land. — In draining clay land, where there is only a layer of a few inches of looser soil over a solid clay, which the plough never stirs, the

Fig. 32.

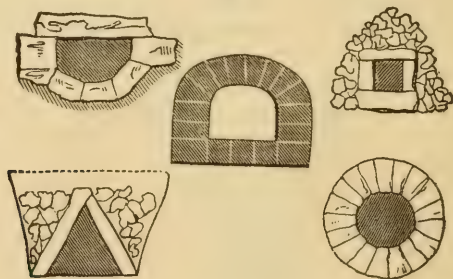


drains need not be deeper than two feet in the solid clay, nor wider than they can be made without the sides falling in. The common draining tile, which is a flat tile bent in the form of half a cylinder, and which can be made at a very cheap rate, is the best for extensive surface draining. In solid clay it requires no flat tile under it ; it is merely an arch to carry the loose stones or earth with which the drain is filled up. Loose round stones or pebbles are the best where they can be procured, and in place of them, bushes, heath, or straw may be laid. In grass land the sod may be laid

over the drain, after it has been filled up, so as to form a slight ridge over it. This will soon sink to a level with the surface. To save the expense of stone or tiles, drains are frequently made six inches wide at the bottom; a narrow channel is cut in the solid clay, two or three inches wide and six deep (*a*), leaving a shoulder on each side to support a sod, which is cut so as to fit the drain, and rest on the shoulder (*b*); this sod keeps the earth from filling the channel. It is filled up as previously described. Where the clay is not sufficiently tenacious, the bottom of the drain is sometimes cut with a sharp angle, and a twisted rope of straw is thrust into it. This keeps the earth from falling in, and the running of the water keeps the channel open; the straw, not being exposed to the air, remains a long time without decaying. It is a common mistake to suppose that in these drains water enters from above;—it rises from below.

Varieties of Drains.—The different sorts of drains in use may be classed in two divisions,—drains of conveyance alone, and drains of conveyance and collection jointly. In the former, all that is necessary is a channel or passage for the water, of sufficient dimensions, which may be formed by pipes of different kinds, arched or barrel drains, and box or walled drains. We give cuts of these, as follows:

Fig. 33.



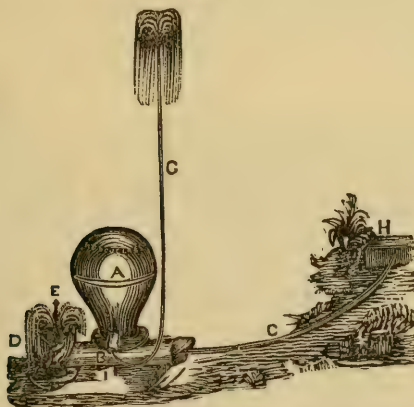
8. IRRIGATING.—Watering poor land, especially of a gravelly nature, is one among the many useful means resorted to by intelligent farmers to improve it and make it fit for cultivation. Land, when once improved by irrigation, is put into a durable state of fertility, and becomes so productive as to yield a large bulk of hay, and the after-math is also valuable. In favorable situations, it produces very early grass, which, on that account, is doubly valuable.

The main object of irrigation in tropical climates seems merely to be to carry to the ground that quantity of water which is necessary for the growth

and nourishment of the plants to be produced; but this species of irrigation is very different from that to which the term is applied in this country. In temperate climates, the purpose is not merely to supply the deficiency of water in the soil. The whole art of irrigation may be defined to be, the supplying a sufficiency of water during all the time the plants are growing, and, secondly, never to allow this water to accumulate so as to stagnate.

The supply of water must come from natural lakes and rivers, or from wells and ponds. As the water must flow over the land, or in channels through it, the supply must be above the level of the land to be irrigated. This is generally the main object to be considered; and the taking of the level is, therefore, the first step towards irrigating. The improved hydraulic ram, seen in the annexed cut, is an excellent machine; *H* represents the spring or brook; *C*, drive or supply pipe, from spring to ram; *G*, pipe conveying water to house, or other point required for use; *E D A E I*, the ram; *J*, the plank or other foundation to which the machine is secured.

Fig. 34.

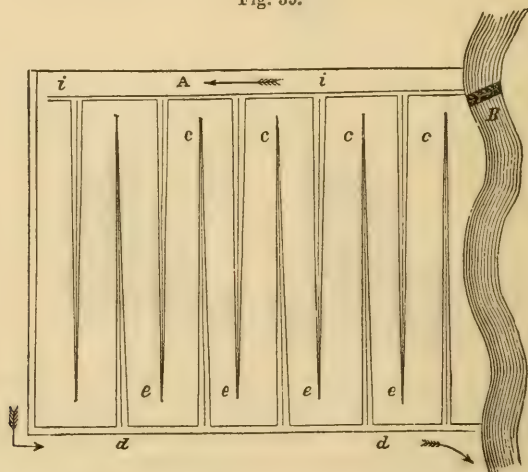


Channels.—Along the banks of running streams nature points out the declivity. A channel which receives the water at a point higher than that to which the river flows, may be dug with a much smaller declivity than that of the bed of the river, and made to carry the water much higher than the natural banks; it may thence be distributed so as to descend slowly, and water a considerable extent of ground, in its way to rejoin the stream. This is a common mode of irrigation, and the shape, size, and direction of the channels, are regulated by the nature of the surface, and other circumstances, which vary in almost every situation.

Kind of Soils for the Purpose. — The soils most suitable for being watered are all those which are of a sandy or gravelly nature, as the improvement is not only more immediate, but the effect more powerful, on those than on any other descriptions of land. It is of advantage that the soil should be incumbent on a warm and absorbent bottom; for the subsoil of watered meadows is considered of more importance than the quality or depth of the surface soil. The best watered meadows are sometimes those in which the soil is only a few inches in depth, especially when the bottom is porous.

Waters Best Adapted. — With regard to the quality of the waters most suitable for irrigation, those of rivers which flow through a rich and cultivated country are to be preferred, as they are enriched by the animal and vegetable matters which they receive in their progress, and which are contained in them in a state of solution. A considerable portion of these matters is left on the surface of the land by the waters passing over it, and it is thereby greatly enriched. Water from bogs is considered inferior, from the antiseptic (resisting putrefaction) quality communicated to it from the peat. Water impregnated with iron has sometimes been used with good effect.

Fig. 35.

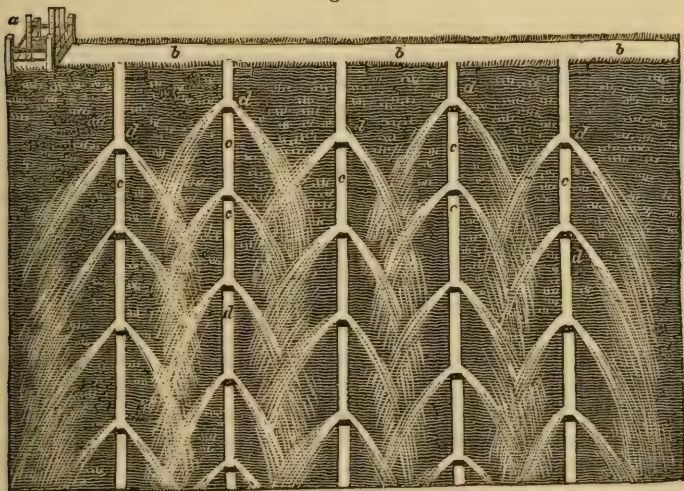


Meadow Watering. — The above diagram represents a watered meadow. A is the main conductor, B the wear placed across the river to intercept the course of the water, and c c c c are the feeders taken off as directed from the main conductor, at right angles to it, by which a constant flow of water is

maintained over the surface. The water is then carried off the meadow by means of the small drains *e e e e*, passing between the intervals of the former, and communicating with the main drain *d d*, which again conveys the water to the river. The dimensions of these smaller drains are seen to be greatest where they respectively join the main conductor and main drain, being then about four inches deep and eight or ten inches wide, and gradually diminishing to a point, as seen in the figure. The dimensions of these drains, however, as well as the distance between them, must be regulated by the extent of the ground to be gone over, and the nature of the soil. It is frequently necessary that the water should be collected and conveyed to another main conductor for watering a meadow in a lower situation ; and when slight inequalities occur in the surface, or when it is wished to convey an additional quantity of water in any particular direction, stops are used for the purpose, which consist of small pieces of sods placed in the drains to cause the water to flow over.

Preparing the Surface. — In the preparation of the surface for irrigation, it is usual to form it into low ridges, the feeders being on the crowns of the ridges, and the drains for carrying off the water in the furrows. The plan illustrated in the preceding figure is designed only for situations in which

Fig. 36.



the inclination is not considerable. In the irrigation of lands with considerable inclination of surface, the feeders cannot be carried along lengthwise,

as in the former case, but across the line of descent, so that the water flowing from one is intercepted by the next lower, and so on until it has covered the whole of the meadow. This is termed catch-work irrigation. The preceding figure is an example of irrigation where the soil is very porous, and gently inclined, the supply of water being abundant. A main carrier is led from the sluice (*a*) directly across the declivity (*b*), and side feeders (*c*) taken out from it at regular distances. These feeders have stops of turf, at regular distances (*d*), by which means the water is dispersed. After watering a space of from twenty to forty feet in breadth, it is again collected by the small drains in the furrows, and returned lower down to another feeder.

The Time to Operate.—The process of floating the meadow commences generally in the month of October, or as soon as possible after the aftermath has been consumed, or the last crop of hay removed. The water is first kept upon the ground for periods of a fortnight or three weeks at a time. It is then let off, and the ground left perfectly dry, for five or six days; and this process of alternate flooding and drying is continued for some time, care being taken to let off the water when it begins to freeze. As the spring advances and the grasses shoot forth, the periods of watering are shortened, so that the flooding shall not last more than a few days at a time.

The formation and arrangement of surfaces for irrigation, however simple in principle, are, in practice, among the most difficult operations of agricultural improvement. Whoever, therefore, contemplates the execution of this kind of work to any considerable extent, will find it desirable to consult a person experienced in the matter.

9. ROTATION OF CROPS.—The fertility or the barrenness of a soil depends upon its constituent parts. If it abounds in those elements which are necessary for the nourishment of the crops to be grown upon it, they will flourish, and yield abundant returns for the labor bestowed upon them; but if any of those substances are wanting which constitute the peculiar food of the growing plants, the yield will be small, and the quality inferior. What one soil, however, may be deficient in, another may possess in abundance; and hence it is requisite to adapt the crop to the soil; though in doing so, care must be taken not to exhaust a generous soil by growing the same crop upon it for a succession of years. Nature herself teaches us, that no soil which has been drained of those combinations of matter which form the appropriate food of the plants growing upon it, can continue to sustain them in a flourishing condition. Even the forests are compelled to yield to this great law, and, after a long

term of years, one kind of timber will give place to another of a totally different character.

The principles upon which a regular succession of crops is based, are: 1. That all plants exhaust the soil, though in an unequal degree. 2. That plants of different kinds do not exhaust the soil in the same manner. 3. That all plants do not restore to the soil a like quantity or quality of manure. 4. That all plants are not equally favorable to the growth of weeds. These principles, confirmed by experience, form the basis of an agricultural system, not only rich in its products, but rendered highly profitable by the economy of labor and manure; and from them the following deductions are a natural consequence: 1. That, however prolific a soil may be, it will eventually become exhausted under a long succession of crops. 2. That, to a certain extent, each harvest impoverishes the soil; the amount of depletion depending upon the proportion of nourishment restored to the earth by its refuse. 3. That the cultivation of one kind of plants should be followed by that of an entirely different variety. 4. That it is necessary to avoid returning too soon to the cultivation of the same, or analogous, kinds of plants on the same land. 5. That it is very injudicious to raise in succession, on the same piece of ground, two varieties of vegetables, which admit of a ready growth of weeds among them. 6. That plants which draw their sustenance entirely from the soil, should be plentifully supplied with manure. 7. That where a soil begins to exhibit symptoms of exhaustion, only those crops should be cultivated which will again restore to it the greatest amount of nutriment.

Though the system of rotation is adapted to every soil, no particular rotation can be assigned to any one description of soil which will answer at all times; much depending on climatic changes, and on the demand for different kinds of produce. But, wherever the system is properly carried out, and the several processes of labor which belong to it are well executed, land will very rarely become foul and exhausted. On clayey soils, beans and clover, with rye-grass, are generally alternated with grain crops; and on dry loams or sandy ground, turnips, beets, potatoes, and clover. On rich soils, or such as are abundantly supplied with putrescent manures, this system of alternate husbandry is certainly most conducive to the plentiful production of food, both for men and animals. One portion of a farm would thus be always under grain crops, while the other portion was growing roots or cultivated grasses; but, as the major part of arable lands cannot be preserved in a state of fertility with even this kind of management, and as sandy soils, even though they be liberally manured, soon become incohesive under constant tillage, it is requi-

site that the portion of the farm which is under cultivated grasses, should be pastured for two or three years, in order to give it time to recruit. If they require it, all the fields of a farm are thus treated in turn.

Light and dry soils will not bear the same kind of crops which grow well on those of a more compact and moist character; and all the different kinds of soils require different rotations of crops. Each farmer, therefore, should establish a system for himself, based upon a thorough acquaintance with the character and properties of the land he cultivates. Intelligent agriculturists, whose lands lie at a distance from market, will endeavor to avoid the expense incident to the transportation of bulky products, by giving the preference to such crops of fodder, or of roots, as may be consumed on the land by live-stock; it being much easier and less costly to carry to market a ton of hay in the form of beef, or a thousand bushels of corn, turnips, or potatoes, in that of pork, than to convey thither a like quantity of those products in their natural condition.

The following system has been very generally adopted by the most successful farmers, in the best cultivated counties of eastern Pennsylvania. After a grass or clover field has been mowed one year, and pastured the following spring and summer, it is ploughed up late in autumn, or in early spring, and planted with Indian corn. When this crop is cut down the succeeding autumn, the field is again ploughed, either then, or during the following spring, and sowed with oats or barley. Immediately after this crop is harvested, the ground is again ploughed up, well manured, and sown with wheat. Grass seed is sown over the wheat early in spring; but if timothy is designed to accompany the clover, the former is sown in autumn, and the latter, with orchard or herd grass, early in spring. The following spring, after the wheat crop has been harvested, ground plaster is sown on the land, in the proportion of one bushel to the acre. The same season the grass is cut for hay, and the next season it is pastured. In the autumn, the land is again ploughed and got ready for planting corn the following spring, and the same rotation proceeded with, in the same order; but where a farm contains a sufficient number of fields, and the grass is well set, it is usual to pasture it for two years before it is broken up for corn. In the first case it is a five, in the latter a six years' rotation. Lime or marl is frequently applied to the young grass as a top-dressing, after the wheat crop has been harvested, with very marked effect on the quantity of grass the first season; and the succeeding crop of corn derives more benefit from it than if applied directly.

CHAPTER II.

THE HEAVY OR FIELD CROPS.

WHEAT—BARLEY—RYE—THE OAT—INDIAN CORN—BUCKWHEAT—THE POTATO—SWEET POTATO—SUGAR BEET—SUGAR CANE—CHINESE SUGAR CANE—AFRICAN SUGAR CANE—COTTON—TOBACCO—RICE—TEA—BROOM CORN—MILLET—HEMP—FLAX—LUCERN—SAINFOIN—THE TARE—CLOVER—THE GRASSES.—MOTIVE POWERS FOR FARM PURPOSES.

WHEAT.

Classification.—Writers on agriculture enumerate something like one hundred varieties of wheat; but the nice distinctions which are necessarily made in multiplying the sorts to such an extent are but of slight importance to the majority of farmers. The best mode of classifying the plants included in this order is by natural marks, that is, by the ear and by the grain. In this way confusion is avoided in describing the ear and the grain. The farmer who grows the wheat plant, and sells it in the grain, should be acquainted with both; but the baker, who is only acquainted with the grain, need know nothing of the ear. Were he, however, to receive an ear of each variety of grain he purchased, he would be best able to describe at once, to the farmer, what particular variety afforded him the flour best suited to his purpose.

An examination of the ears of wheat proves that they may be consistently divided into three classes, as represented in the following figure, and distinguishable thus:—

a is a close or compact eared wheat, which is occasioned by the spikelets being set near each other on the rachis, and this position makes the chaff short and broad. The second class of ears is seen at *b*, the spikelets being of medium length and breadth, and placed just so close upon the rachis as to screen it from view; the ear is not so broad, but longer than *a*; the chaff is of medium length and breadth. The third class is seen at *c*, the spikelets of which are set open, or so far asunder, as to permit the rachis to be easily seen between them; the ear is about the same length as the last specimen, but is much narrower; the chaff is long and narrow. In *d* is represented a bearded wheat, to show the difference of appearance which the beard gives to the ear. The term bearded is applied the same as spring wheat; beardless wheat, however, is as fit for sowing in spring as bearded, and the bearded may be sown in winter.

In regard to classifying wheat by the grain, three heads may comprise all the varieties. (See Fig. 38.) The first class (*a*) is where all the grains

Fig. 37.



are short, round, and plump. The second class (*b*), where the grains are long and of medium size. The third class (*c*), where the grain is large

Fig. 38.



and long to a greater degree than the last class. These three sorts are represented according to their natural size.

Best Varieties for Cultivation. — The following are the names of the kinds of wheat most esteemed and cultivated in this country. *White Flint*: This is one of the most valuable kinds in the northern states. The heads are not too long, but well filled, with thirty to forty grains; the kernel is white and flinty, large, and with thin bran; the flour is very superior; the perfect wheat weighs from 63 to 67 pounds the bushel. *Harmon's White Flint*: A variety improved from the above; the berry is larger, bran very thin, flour superior; this and the above are little injured by the Hessian fly, and will stand a good deal of wet weather. *White Provence*: Heads middling and bald, chaff bluish, berry large and white, bran thin, flour good; it is early, but the straw is small, long, soft, and liable to fall. *Old Genesee Red Chaff*: An old favorite, but liable to rust and the fly; red chaff, bald, long straw, berry white and large, bran thin, superior flour. *Kentucky White-bearded, Hutchinson or Canada Flint*: White chaff, bearded, heads short but heavy and well filled, shells readily, berries round, short and white, flour very good; it litters a little; the straw is strong, but liable to injury from insects. *Indiana Wheat*: White chaff, bald, berry white and large, bran thin, berry not so flinty as the white flint, but the straw is larger and longer; shells easily; is attacked by the insects, and it is more liable to be winter-killed. A variety of white wheat is much esteemed in western New York, which resembles an improved Indiana; it is called *Scotch Wheat*. *Virginia White May*: White chaff, bald, and resembles the white flint in its growth and straw, though the heads are more clumped, the berry stands out more, and shells easier; berry white and hard, bran medium thick, flour good; matures early. *Wheatland Red*: Red chaff, bald, heads of medium length, red berry, good flour, very hardy, bright and large straw, ripens early. *Red Bearded*: Red chaff, beards standing out from the head, berry white, good flour, hardy, succeeds well after corn, or on light soils. *Mediterranean*: Light red chaff, bearded, berry red and long, flinty, bran thick, inferior flour. *Blue Stem*: Has been grown in Virginia for about thirty years; white chaff, bald, berry white, bran thin, superior flour, straw fair size and good product. *The Yorkshire or English Flint, or Soule's Wheat*, much praised, is similar in its leading features to the old Genesee. *The Egyptian, Smyrna, Reed, Many-spiked, or Wild Goose Wheat*. Crossing will produce new varieties. Propagation may be extended by separating the plants.

Red wheat is usually grown upon the strongest clay land, and degenerates when sown upon a soil of a lighter description. It is hardy, and as it is better adapted to insure the production of a crop on wet, adhesive soils, it is very generally sown on that class of lands; but, on all the

better class of soils, the white or smooth-chaffed wheat is preferable, the thinness of the husk rendering it more valuable to the miller.

Winter wheat is sometimes confounded with spring wheat, the only distinction being in the different periods of ripening. The produce of wheat sown in the spring acquires the habit of ripening earlier than the produce of that sown in autumn. This distinction is not, however, an absolute or permanent one.

Soils. — The soils best adapted for the culture of wheat are the rich clays and the heavy loams, though these are not, by any means, the only descriptions of soils on which it may be cultivated. Before the introduction of turnips and clover, all soils but little adhesive were thought unfit for wheat; but even on sandy soils it is now extensively cultivated, after either of these crops. Such soils, however, are not constitutionally disposed to the growth of wheat; nor will they, under any management, bear such a frequent repetition of it as those already mentioned. To bring wheat to perfection, a dry and warm season is required.

Time for Sowing. — The season of sowing wheat depends on the crop to which it succeeds. It is sown before winter, when the land can be then prepared for its reception, as after fallow or potatoes; and it is sown in spring after turnips, cabbages, and such other crops as are not removed off the land till that season. The time of sowing must depend, also, on the state of the land, as well as the season. It is, however, generally recommended to put it into the ground as early as may be convenient in autumn; and on strong soils it is not unfrequently sown in the latter end of September, in the course of October, and the beginning of November.

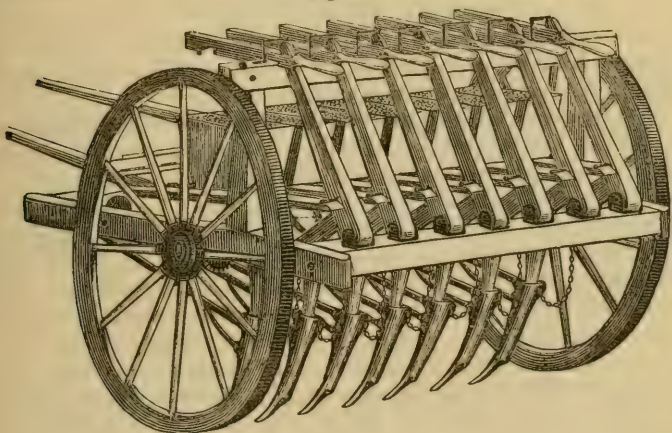
Seed Wheat. — Seed wheat is prepared by a process termed *pickling*, before being sown. This is intended to prevent rust, of which it is a preventative. Various substances are employed as a pickle to wash the seed, the most common and useful being a solution of common salt in water, sufficiently strong to buoy up a fresh egg. After being freed from all foreign substances, the seed is dried, and, if not sown immediately after must be spread thinly over the floor, to prevent its heating.

Culture. — When the seed is sown broadcast, it is covered by the action of the harrows sufficiently to cover the seed. A double turn along the ridge, a double turn across, and again a single turn along, will generally suffice, and oftentimes less than so much. As soon as the seed is harrowed in, the whole should be water-furrowed, to carry all excess of moisture off the land, by means of the double mould-board plough, with one horse, passing along the furrows of the field, and the furrows of the head-lands. Open furrows are also to be drawn through such hollow parts as the water might stagnate in, care being taken to sink all inequalities,

that a passage may be afforded for the water to run off. The intersection of the furrows of the field with those of the head-lands are also to be cleared out, and cuts made occasionally through the head-lands.

On the lighter class of soils, ploughing in the seed may be adopted. The seed is sown broadcast; after which a shallow ploughing is given to the land, and, perhaps, a slight harrowing. The horse-drill, now much in vogue, will plant wheat, rye, Indian corn, &c., on all kinds of lands. See figure.

Fig. 39.



Quantity of Seed.—The quantity of seed necessarily depends on the time and mode of sowing, and the state of the land; land sown early requiring less seed than the same land when sown late, and poor land being, at all times, allowed more seed than rich; also, when sown broadcast, more seed is given than when either dibbled or sown in drills. The quantity, therefore, varies from two bushels, or less, to as many as four. Winter wheat, when sown in spring, should always have considerable seed. Good and improved soils require less than soils not so good, and on the former the plants are less liable to be injured during the winter, and generally all come to maturity.

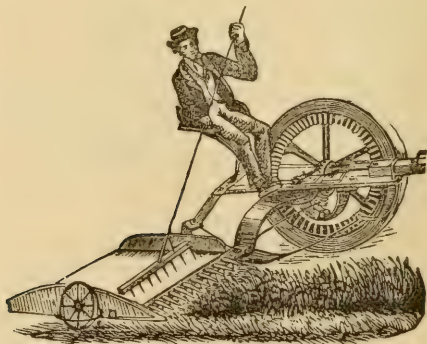
After-Culture.—The after-culture of wheat, or culture of the growing crop, is chiefly confined to harrowing, rolling, hoeing, and weeding. Harrowing is found beneficial in penetrating the crust which is formed on tenacious soils, and raises a fresh supply of mould to the roots of the plants. Rolling in spring should be practised on dry, porous soils, which are fre-

quently left in so loose a state by the winter frosts, that the roots are thrown out of the ground, and perish. Hoeing is performed when the row-culture is adopted, to pulverize the intervals between the rows, and to check the growth of weeds.

Cutting and Harvesting.—The grain should be cut immediately after the lowest part of the stalk becomes yellow, while the grain is yet in the dough state, and easily compressible between the thumb and finger. If cut at this time, it will yield more in measure and weight, and a larger quantity of sweet, white flour. If early cut, a longer time is required for curing, before storing or threshing. The latter operation is usually done, by extensive wheat-growers, with a large machine, taken into the field, and driven by horse-power; with moderate farmers, a small single or double horse-machine, or hand-threshing in winter.

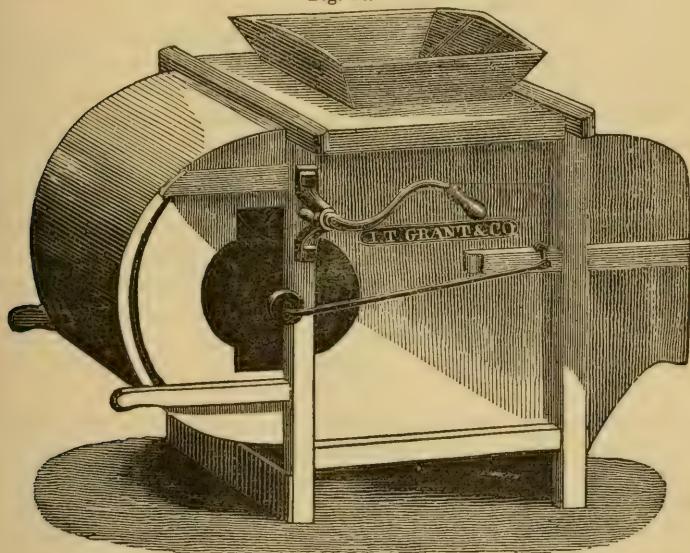
If the grain is perfectly ripe, and the straw thoroughly dried, and the sheaves free from grass or weeds, wheat may be cut and stacked or housed the same day. It must, however, be effectually cured in the fields. To save it from wetting, some farmers lay it in the form of a cross, surmounted with a sheaf so disposed as to throw off any slight showers that may fall; others place it in shocks, the sheaves two and two, standing on their butts, the heads of the sheaves inclined to each other, and the tops spread out so as to shield the standing sheaves as much as possible; others, again, place their wheat in the same position as the last, with the exception that all of the shock is left standing, and no sheaves are placed over the heads. Unless very dry, it should be laid on scaffolds, when taken into the barn, to prevent heating and moulding. When placed in a stack, it should be well elevated from the ground, and, if the stack be large, a chimney of lattice or

Fig. 40.



open-work should be left from the bottom, extending to the top, to produce circulation. The straw or chaff yields good fodder, when cut or mixed with meal or roots; it is also good for bedding cattle, for manure, and should never be wasted. The fan-mill, for cleaning grain, is too well known to be described in this place.

Fig. 41.



Enemies of Wheat. — Wheat is subject to various diseases, principally the mildew, smut, and rust. Mildew is indicated by the presence of certain minute plants of the order of *fungi*, which grow upon the stem and leaves, and doubtless feed upon and exhaust the juices of the plant. The prevalence of heavy fogs or mist, drizzling rains, and sudden changes of temperature, have been assigned as the cause of mildew, and it has been found that open, airy situations are much less subject to it than low sheltered lands. To remove this destructive agent, the use of salt is highly recommended. The quantity of salt per gallon is eight ounces, and the application is more effectual if frequently repeated, and does no injury to the plants. If the application is not made during a cloudy day, it is best to defer it until evening.

When wheat is infected with the smut, the farina of the grain, together with its proper coverings, and part of the husk, is converted into a black,

soot-like powder This disease does not affect the whole of the crop, but the smutted ears are sometimes very numerous dispersed through it. If the seed be prepared in the way already described, the disease will rarely prevail to such an extent as to affect materially the value of the crop.

Rust is another very prevalent disease, nearly allied to the mildew. It appears in the form of a brownish dust upon the stem, leaves, and seed, and, like the others, is produced by a parasitical plant.

The roots of the wheat plant are liable to be attacked by grubs and worms, the larvæ of various beetles; among these are the wire-worm, and the red-headed large white grub, the larvæ of the May-bug, cockchaffer, or black bug. These often do much injury, and late ploughing is the best mode of destroying them, by thus exposing them to the frosts; when they appear in the summer, they are sometimes destroyed by being attracted towards large fires, kindled for the purpose, and perishing in them. But the insects that attack the wheat while growing and in the ear are by far the most powerful enemies which it encounters. These insects are the Hessian fly and the wheat fly. The former has a black head, thorax, and wings, with a brownish body; the latter is of smaller size, of a yellow color, and clear wings. (See Chapter on INSECTS.)

BARLEY.

Classification. — The natural classification of barley by the ear is obviously of three kinds, — four-rowed, six-rowed, and two-rowed, as in Fig. 43.

In Fig. 43, *a* is the four-rowed, or bere or bigg; *c* is the six-rowed; and *b* the two-rowed.

When classified by the grain, there are two kinds, bere or bigg, and barley; and though both are awned, they are sufficiently marked to constitute distinct varieties. In the bere (Fig. 42, *a*), the median line of the bosam is so traced as to give the grain a twisted form, by which one of its sides is larger than the other, and the lengthened point is from where the awn has been broken off. In the barley (*b*), the median line passes straight, and divides the grain into two equal sides, and whose shortness and plumpness give to it a character of superiority. Both kinds are represented below, natural size:—

Fig. 42.

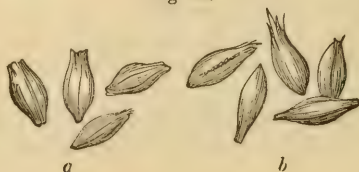


Fig. 43.



In this country the two-rowed and the six-rowed are the varieties generally cultivated, the two-rowed being the kind most esteemed.

Kind of Soil. — The best soil for barley is a rich loam finely pulverized. It will neither grow well on a sandy or a soft soil, nor on strong clays, such as are suitable for wheat. It is rarely made to succeed summer fallow, wheat being, in an especial degree, suited to follow that process, and it being also the more valuable crop. For a like reason it seldom succeeds potatoes, as wheat may advantageously be sown at the period of the removal of the potato crop from the ground. But it succeeds turnips with greater propriety than any other crop, the turnip crop being cultivated on the lighter soils, which are the proper soils for barley.

Barley ripens early in autumn, and it may, therefore, be sown later than any of the other corn crops in the spring. The best season may be said to be in the month of April or beginning of May. An increased quantity of straw is produced by late sowing, but the grain is surer the more early that the crop is sown.

Preparing the Land. — The preparation of land for barley is similar to that for wheat. After turnips, or other green crop removed in the spring, the land is to be ploughed once, after which the seed is to be immediately sown. Two ploughings, however, will be necessary when barley succeeds any of the grain crops removed before winter, and, in this case, the land should have been drilled up after the removal of the crop, to keep it dry. As it is found of great importance, with a view to speedy and equal vegetation, that the ground should be fresh and moist at the time of sowing, barley should then be sown as soon as possible after the seed-furrow is given.

Sowing. — The modes of sowing barley are either broadcast or in rows. The broadcast system is almost universally employed in the cultivation of this plant, unless in lands much infested with annual weeds, where drilling and hand-hoeing, and, sometimes, horse-hoeing, may be adopted with advantage. The quantity of seed varies from two and a half to three bushels to the acre, according to the kind of seed used, the nature of the soil, and the time of sowing. Liberal sowing is most profitable; and, when sown late in the season, and in dry weather, the seed is sometimes steeped in water for a day, to promote a more early and uniform germination.

Culture. — The seeds of the clovers and grasses are sown simultaneously with the barley, the succeeding crop being invariably grass. In this case, the smaller seeds are sown immediately before the last turn of the harrows, and that turn covers them in. The land is to be rolled afterwards, in order to exclude drought, pulverize the soil, and cover the clover and grass seeds.

Harvesting. — In the harvesting of barley more care and attention are requisite than in the case of any of the other grain crops, even in the best seasons; and, in unfavorable seasons, it is almost impossible to save it without injury. Owing to the brittleness of the stem after it has reached a certain period, it must be cut down; for when it is suffered to stand longer, much

Fig. 44.



loss is sustained by the breaking off of the heads. On that account, it is cut at a time when the grain is soft, and the straw retains a great proportion of its

natural juices, and consequently requires a long time in the field before either the grain is hardened or the straw sufficiently dry.

Threshing and Dressing.—The threshing and dressing of barley are attended with more labor than is the case with any other grain, owing to the tenacity with which the covers adhere to the seeds. After being threshed in the ordinary way, it is a frequent practice to put the threshed grain a second time through the machine, accompanied by a portion of straw. Should this not accomplish the work effectively, then the hummelling machine (Fig. 44) is used.

Uses.—Barley is used in Europe as a staple article of food. It is inferior, however, to wheat and rye. In this country it is principally used for malting and brewing, and for distilling. When ground, it is good for fattening stock, though more especially swine.

Enemies.—The diseases of barley are few. It is sometimes attacked by the larvæ of certain flies. It is also subject to smut, but of quite a different character from that which affects wheat, and one which, it is found, cannot be prevented by pickling and liming.

RYE.

Varieties.—Of rye, there is, strictly speaking, only one variety, although it is usually divided into winter and spring rye; but these are produced merely by the different periods of sowing, and resemble each other so much, that, when sown together, they cannot be distinguished.

Fig. 45.



Soil.—The soil for rye may be inferior to that chosen for wheat, and it will succeed with less culture and manure. The soils best suited to its

growth are those which contain the greatest proportion of sand, and there are instances on record in which it succeeded on land containing eighty-five per cent. of this substance. Those soils, however, which contain a less proportion of sand are preferable; for, though it will grow upon ground of the poorest description, yet the produce will be more abundant upon good land, provided it be not of a clayey nature. In this country it is grown in the north-eastern and middle Atlantic states, and on the light lands of Ohio and Michigan; and, as the supporting elements of wheat become exhausted in the soil of the rich agricultural states of the West, rye will in a great measure take its place on their lighter soils.

Time for Sowing.—Rye may be sown either in the autumn or in spring, and, as in the case of wheat, the period of ripening is affected by that of sowing. The quantity of seed may be two bushels and a half to the acre, but, when grown for straw plait, this quantity is more than doubled. As it vegetates more slowly than wheat, it should be sown when the soil is dry; otherwise, the grain is in danger of rotting in the ground before it has completely germinated.

Culture.—Rye, being sown upon light and poor soils, obtains less attention in its production than wheat; it also suffers less from being sown upon the stubble of another corn crop, or even upon its own; and it is therefore not unusual to grow it successively two years upon the same land, but this is somewhat contrary to the principles of good husbandry, and cannot be recommended for imitation.

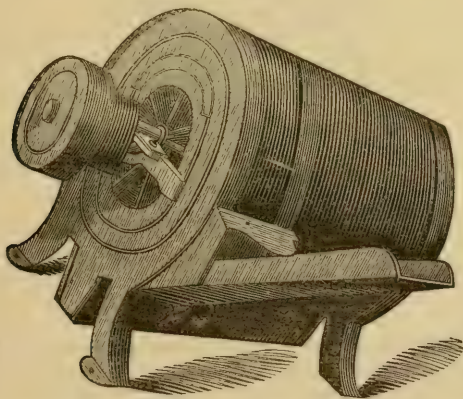
The after-culture, harvesting, and threshing of the crop, are similar to those of wheat. The horizontal fan-mill, for cleaning grain, has been somewhat popular in the Eastern States.

The period of flowering is more decisive of the prospect to be entertained regarding the success of rye than in the case of any other grain; and, until it be past, no opinion can be correctly formed on the subject. The ripening of the grain is earlier than that of wheat, and is denoted by the straw losing somewhat of its bright yellow color, becoming paler, and the knots of the straw losing their green color. The corn then sheds easily from the ear. When allowed to stand until very ripe, a shower of rain will occasion it to sprout.

Product and Uses.—The produce of rye is nearly the same as that of moderate crops of wheat, but seldom amounts to those which are very large; the quantity of straw is greater than that of any other grain. It grows to a greater height than the straw of wheat, and, though thinner in the stem, is stronger; but being hard and wiry, it is not esteemed for fodder, and the chief use of it is for thatch. It is also valuable to brick-makers, and is extensively used in the manufacture of straw hats. For the latter purpose,

it is sown very thick, pulled green, and blanched by exposure to the air. It is also used both in the brewery and distillery; and in many parts, after undergoing a species of bruising or coarse grinding, it is used alone, or mixed with barley, oats, beans, peas, or tares, which have undergone a similar operation, and formed into a kind of coarse bread, for feeding domestic animals, particularly horses. Its bread contains a less proportion of nutritive matter than that of wheat, but it is found to keep longer, and forms about the only bread eaten by the inhabitants of some countries where the soil and climate are unsuited for the growth of wheat. It contains a greater quantity of nutritive matter than either barley or oats, and the husk possesses an aromatic and slightly acid flavor, which renders it agreeable to the palate. The bran should not, therefore, be entirely separated from the flour, for, if the grain be ground fine, and divested of the husk, the bread will be deprived of much of its pleasant taste. When intended for consumption in the farmer's family, it is usual to mix a certain portion of wheat with the seed before sowing, or the mixture may be made after they are ground into flour, which is the better practice. The proportions may be one third of rye and two thirds of wheaten flour, and this combination makes a sweeter bread than that made solely of wheat.

Fig. 46.



Enemies. — Rye is subject to most of the diseases which attack the order of plants to which it belongs, such as rust, mildew, burned-ear, and smut-ball. But there is one remarkable disease, which, although it is sometimes found in wheat, is much more common in rye. It is called the ergot, the French name of a cock's spur, which the diseased grain resembles in shape.

By some perversion of the vital functions of the plant, the embryo, or germen, instead of growing into a regular seed filled with farina, shoots out a long, black, fungus-like substance, several times the length of a common seed, which rises above the chaff, and has the appearance of a slender pyramid, slightly bent on one side. This substance is soft, and easily broken or cut, and is uniform in its internal texture, without any husk or skin over it. It is not only destructive to the grain, but very poisonous when eaten mixed with the flour.

Figure 46 is Pilkinton's machine for cleaning smutty grain, and to take out chaff, onions, and heavy grit.

THE OAT.

Varieties.—Of all the cultivated grains, oats are the easiest of culture, and the most certain and prolific in their product. There are several varieties. Fig. 47 represents two of the most marked and useful.

Fig. 47.



That represented in the cut *a* is the *White* or *Common Oat*, known by its white husk and kernel, and is the kind most commonly cultivated. The *Siberian* or *Tartarian Oat* (*b*) is a black or brown grain, thin, rather small, and turned mostly to one side of the panicle or ear. The straw is large and reedy, but it is usually very productive, and is well calculated for poor soils and exposed situations. The *Red Oat*, known by its brownish-red husk, thin and flexible stem, and firmly attached grains, is an early variety, suffers but little from winds, makes good meal, and suits exposed situations.

and late climates. The *Poland Oat* is known by its thick, white husk, awnless chaff, solitary grains, short, white kernel, and short, stiff straw; it requires a dry, warm soil, and is very prolific; the black Poland oat is regarded as one of the best varieties. The *Dutch Oat* has plump, thin-skinned, white grains, mostly double, and the large ones sometimes awned. It has larger straw than the Poland, but in other respects resembles it. The *Potato Oat* has large, plump, rather thick-skinned, white grains, double and treble, and with longer straw than either of the few preceding varieties. The *Georgian Oat* is a large-grained and very prolific variety. The *Imperial Oat* is the heaviest raised in the United States, and by many is preferred to all others; it is a clean, bright, plump, heavy grain, yielding a large proportion of flour and nutritive matter. It is hardy, and yields well in the Northern and Middle States. The *Egyptian Oat* is grown in large quantities south of Tennessee, and is very well adapted for the South.

Soil. — The soil for the oat may be almost any kind whatever, from the stiffest clays, to moss, or bog, provided it be laid sufficiently dry. They will produce well on reclaimed bog and mountain; but as these usually grow straw luxuriantly, especially if they have been improved by paring and burning the surface, a green crop should be taken the first year, which will allow time for the active properties of the ashes to subside; and the following year oats may be considered a certain and productive crop.

Preparing the Land. — The preparation of the land for oats is less than for any other crop. It is almost always the first crop on newly broken-up lands, and, as it succeeds best on a soil not too finely pulverized, it is sown after a single ploughing. In regular rotations, oats are chiefly sown after grass. It is sometimes sown upon land not rich enough for wheat, that has been previously under green crop. One ploughing is generally given to the grass lands, which should be done as soon in spring as the state of the weather and the other labors of the farm will allow. When oats succeed a green crop, the preparation of the land is the same as that for wheat.

Sowing and Culture. — The period for sowing oats is generally from the beginning of March to the middle of April. The month of March is considered by many to be the best for seed-time. They are sometimes sown in February, also in the autumn; but the crops sown at a later period of the season have, in most cases, been greatly more productive. The quantity of seeds is from four to six bushels to the acre. In sowing oats, the quantity must be regulated by the shape and size of the grain, as well as by the condition of the soil. Land sown with potato oats, for instance, requires less seed, in point of measure, than when any of the other sorts is used, first, because this variety litters better than any other, and, having no awns,

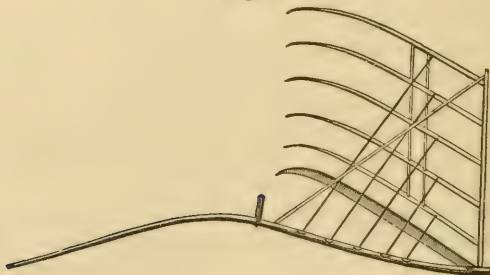
a greater number of grains is contained in a bushel. Some varieties, too, are more leafy than others, and require to stand further apart; in general, however, four bushels will be necessary on medium soils, and, in poor, upland soils, as many as six may be required.

Grass-seeds may be sown in spring with oats, in the same manner as with wheat or barley. The young clover and grass are, however, in danger of being smothered by the oat crop, unless when it is sown very thin. If, therefore, through necessity, this system should be adopted, the oats should be sown thin, on well-prepared land, and the smaller seeds harrowed in when the plants are sufficiently strong to bear the surface being stirred. When the land is in a highly pulverized state, it may be better to sow the seeds of the clovers and grasses immediately before giving the last turn of the harrows for covering the oats.

Being usually sown after grass land, oats are more apt to be overrun with thistles, and other large weeds, than any other crop. These are to be cut over with the weed-hook, or pulled up by the weeding clips, before the crop comes into ear.

Reaping. — The reaping of oats is performed with the scythe or sickle. It may, with great convenience, be performed with the scythe, and should be done when the grain becomes hard and the straw of a yellowish color.

Fig. 48.



The crop should be cut before it is dead ripe, to prevent the shedding of the grain, and to increase the value of the straw for fodder.

Enemies. — The diseases of the oat are few. Sometimes it is attacked by smut, but more commonly by the wire-worm, or larvæ of insects, which generally abound in newly broken-up lands. To guard against these, delay ploughing the land, especially if long in grass, until immediately before sowing.

INDIAN CORN.

Varieties.—The varieties of corn cultivated in this country are quite numerous, distinguished by peculiar characteristics of the grain, cob, &c., and are frequently enumerated and described as follows:—

Fig. 49.



Yellow Corn.—The *Yellow Gourdseed*, so called from the resemblance of its long narrow grains to the seed of the gourd; this has 24, and occasionally even more rows. The genuine *King Philip*, with 8 rows; a hardy plant. The *Sioux*, or yellow flint corn, with 12 rows; also the *Sioux* variety grown in Pennsylvania; also the *Sioux* and *Gourdseed* mixed, 16 rows.

White Indian Corn.—This includes the *White Flint*, *White Flour Corn*, and *White Sugar* or *Sweet Corn*, and the *White Gourdseed*. The *Genuine White Flint* is the twelve-row corn, raised in Virginia. The *White Flint* has 10 rows. The *Early White Flint*, and *White Flour Corn*, has 12 rows. The *Peruvian Corn* has 8 rows. The *Pennsylvania*—called, in Maryland, *Smith's Early White*—has 8 rows. The *New Jersey* has 8 rows. The *New York*, 10 rows; and *Mandan Indian Corn*. The *Early Sugar Corn*, with shrunken grains, has 12 rows.

Blood-Red Indian Corn.—Varieties are as follows:—Common-sized *Hæmetite*, with 12 rows and red cob; red cob with white grains; red cob with yellow grains; red cob with brown grains; red cob with white gourdseed; red cob with gourdseed and yellow flint; white cob with red

grain ; speckled red and yellow grains on a white cob ; the same on a red cob : the dwarf Hæmetite, commonly called Guinea corn ; blue corn with 10 rows ; the celebrated Dutton corn, &c., &c.

Of these numerous varieties, some are best adapted to the Southern States—the white and yellow gourdseeds ; others to the Middle States—the gourdseed and flint varieties, pure or mixed ; whilst the heavy flinty-grained kinds are almost exclusively cultivated in the Northern and Eastern States, to which they are specially adapted by their disposition to grow and mature with great rapidity, and thus accommodate themselves to the shortness of northern summers. Like all early maturing corn, they are dwarfish, though very productive. The effect of the longer and warmer summers, in more southerly situations, is to favor greatly the growth of the stalk. The time taken by different varieties in growing and maturing differs exceedingly. In the Southern and Middle States the crop occupies the ground from five to seven months, whilst in the Northern and Eastern States the ears come to maturity in three or four months.

Among the varieties of corn cultivated for special purposes are the White Flint, used for making hommony ; the Flour Corn, with a round, thick grain, filled with a snowy white powder, resembling starch, much used for grinding up with buckwheat, in the proportion of about one fourth or one fifth of the corn, giving the buckwheat-meal a lighter color, and otherwise improving it ; the Early Jersey truck corn, a middle-sized ear, with white and rather flinty grains, the earliest corn raised for the market,—two kinds, the white and the red cob ; and the Small Flinty-grained corn, usually raised for parching or popping.

Preparation of the Land for Planting.—In the Middle States corn is planted in all conditions of the land ; but in Virginia and Maryland it generally follows the wheat crop, upon which all the farm-yard manure has been spread. In the upper portion of Delaware and in Pennsylvania, the crop is generally put upon a grass sward or clover lay. Where the soil is a stiff clay, much labor is bestowed in ploughing deep, then rolling, and reducing to the finest tilth by means of harrows. As a general rule, after a sward has been turned, care is taken not to harrow so deep as to reach and drag up the sods, which are suffered to lie and decompose, thus furnishing nutriment to the corn, and keeping the ground loose and favorable to the spreading of the roots. Many farmers spread lime upon the land intended for corn, in the autumn or winter, previously to ploughing. Others put the lime dressing on the ploughed ground.

Season for Ploughing.—With regard to the best time for ploughing, this must depend much upon the character of the soil. Late fall or winter ploughing has been thought useful in turning up and exposing to perish the

grubs and other insects which have retreated below the surface for winter quarters ; but in Pennsylvania this practice is now generally abandoned in favor of spring ploughing.

The roller, when used, must be drawn in the direction of the furrows, and never crosswise. Then follows the drag-harrow, in the same direction, being the last instrument which, on flushed ground, is employed preparatory to planting. The harrowing should be continued until the surface of the inverted sward is completely broken up and pulverized.

In the Middle States, it is customary to prepare the ground for corn by a method called listing, or double furrowing ; that is, ploughing so as at first to turn two furrow-slices together, leaving a middle space, which is afterwards ploughed out by turning an additional furrow on each side. This places the ground in narrow lands or ridges, consisting of four furrow-slices, with deep intervening trenches. The width from the middle of one land to the other is generally about four feet. In signing out for planting, a plough is run across these narrow lands, so as to strike out rows generally four feet apart. The plough which performs this cross-ploughing is immediately followed by a boy who drops four, five, or seven grains of corn directly opposite the middle of each of the ridges, and the operation of planting is completed by a man who covers the seed with a hoe. Corn should be planted as early in the spring as the weather will permit. The usual time of planting in the Floridas is early in March, whilst in the Eastern States it cannot be done, as a general rule, before the middle of May.

Planting. — After rolling, and then harrowing well, the rows are struck out very shallow, and the corn is planted in hills, 3, 4, $4\frac{1}{2}$, or 5 feet apart or dropped in rows from three to five feet asunder, so as to leave the stalks when thinned out, about one or two feet apart. In this last case, the tillage has of course to be conducted in the direction of the rows, and never crosswise, as is practised when the grain is in hills at regular distances. When the growth is high, and the soil rich, the rows should be further apart than where the growth is low, as is the case with the Northern varieties, which may be planted three feet apart.

Manuring. — Whenever manure can be spared for the corn crop, it will always make a good return. It may be spread broadcast upon the land previously to ploughing, or, what is better, spread upon ground that has been flushed up in the autumn or winter, and then lightly ploughed in. In the Northern and Eastern States, where the summers are short, a liberal quantity of manure is generally required to assist in forcing the crop to early maturity. When not enough is at hand to afford a good dressing broadcast, it is advisable to apply a portion of short manure to each hill just before planting. Ashes are an excellent manure for Indian corn, and

may be merely dropped upon the hills. It is common to make a mixture of these with lime and plaster; but there is no doubt that the main benefit of the mixture proceeds from the live ashes. Poudrette is also applied, and with good effect — one gill to each hill; it pushes the young corn forward with such rapidity as to place it very soon beyond danger from the grub, cut-worm, and other insect depredators. The same end may also be promoted by soaking the seed twenty-four or thirty-six hours in solutions of saltpetre, urine, the drainings of the stables and the cattle-yards. Strong solutions of copperas, blue vitriol, are sometimes used. To protect the seed against its enemies, some farmers soak the seed twelve to twenty hours in hot water, in which are dissolved a few ounces of crude saltpetre, and then add (say to eight quarts of seed) half a pint of tar, previously warmed and diluted with a quart of warm water. The mass is well stirred, the corn taken out, and as much plaster added as will adhere to the grain. This impregnates and partially coats the seed with tar.

Fig. 50.



Number of Grains to the Hill, and Depth of Planting.—Where there is reason to apprehend much mischief to the young plants from blackbirds, crows, insects, and other vermin, it is best to plant four to seven grains in each hill, so that some of them may have a chance to escape. The deficiency is usually attempted to be made up by replanting other grain, but the product of this replant is too often feeble, and so late in maturing as to be frequently injured by the frost in autumn. A better plan is to replant with the surplus of other hills, though this requires a damp and very favorable condition of the weather. As to the proper depth of covering for the seed, much difference of opinion exists. The corn-planter here figured has the advantage of pushing the grain down in the ground to the depth of four inches, where it leaves it covered up, and in close contact with the soil; 4 to 8 grains are deposited in each place; the grains passing down from each corner of the machine. A deeper covering would either cause the grain to rot, or prevent it from rising.

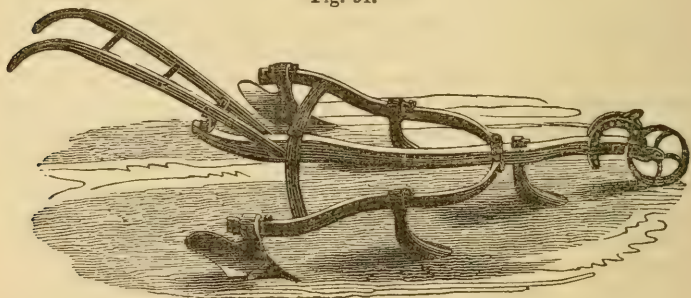
Tillage.—The corn once planted, its tender blade pushes through the

ground, usually in about a week or ten days, and even sooner when the seed has been soaked. Although the field is generally left at rest until the plants have all fairly risen above ground, before tillage of the crop is commenced, some begin with the harrows even before the corn is up. The first objects to be effected are to keep the ground stirred and free from grass and weeds. Where danger is apprehended from worms, by which it is so frequently attacked, many maintain that the tillage should not commence very soon, so that, some other vegetation being allowed to start up, the young corn will thus be in a measure spared; whereas, if the ground is perfectly clean, the worms, having nothing else to feed upon, will, of course, destroy all the young corn. Instances may occasionally occur where this practice may prove disadvantageous, but, as a general rule, the young corn cannot be kept too clean, or the ground about it too loose.

The modes of tillage vary exceedingly, not only with the variations in soil and climate, but with the views of different persons in the same locality. On stiff clay soils, there is no doubt that harrowing just before the proper time for the corn to come up favors this process, by loosening the tenacious soil, especially where a timely rain does not occur to soften the earth. After the corn appears, the harrow should be kept going until the ground is rendered perfectly loose, hands following with hoes or short rakes, to clear the corn which may be covered. Then comes the plough, which, in the Southern and lower portion of the Middle States, is often used to turn a furrow from the young corn. This operation is termed bar-ploughing, because the bar of the plough is run next to the plants. A few days after this, the process is renewed, and the mould-board being turned next the corn, the loose earth is thrown back again. Many think that this second ploughing, called moulding, ought not to be left longer than a few hours before the earth should be turned back again. In some places ploughs are still used for this purpose with wooden mould-boards, as these serve best to push the loose earth before them, crumbling and spreading it about the plants more advantageously than ploughs furnished with smooth and polished iron mould-boards. Some use narrow, deep-cutting ploughs, which do this work with comparatively little labor to the horse, and render the soil near the corn much more permeable by the roots, and at the same time quickly accessible to the rain and atmospheric influences. Whatever tends to favor the extension of the roots downwards, serves to place the crop beyond the vicissitudes of the season. There is, perhaps, no plant which withstands the effects of drought so well as Indian corn, whilst young; but when its top blades begin to be heavy, its demands for moisture increase so as to cause it to suffer greatly from very dry weather. Heat and moisture are the great promoters of its growth

The farmers in some of the finest districts in Pennsylvania have, of late years, made much less use of the plough, in cultivating their corn, than formerly. They now generally content themselves with moulding, or throwing a single furrow on each side of the young plants, leaving a space of from three to three and a half feet untouched. The space left is afterwards worked by means of shovel-ploughs, and cultivators (Fig. 51), which completely destroy the grass and loosen the ground. This mode of culture

Fig. 51.



is more easily and economically performed than the old plan of ploughing the whole space between the rows, and leaving the surface completely level. If the land be sufficiently loose and deeply stirred, there is little use in hilling it. It is sometimes said that corn requires hilling to support it. Nature disproves this, by the stiff, bracing roots thrown out by this plant at the time they are wanted, and for this very purpose. On wet lands, planting on ridges and hilling may be advisable, but such lands should not be chosen for corn. If wet, drain thoroughly, in the first place. Allow no weeds to grow, and do not fear to stir the surface in dry weather. Many farmers deem the use of the plough altogether unnecessary, and even injurious, and conduct the tillage of the corn crop throughout, first with the drag-harrow, and successively with the cultivator, horse-hoe, and hand-hoe.

Thinning and Suckering. — As quickly as possible after it is ascertained that the plants are in a thrifty condition, and no longer in danger of being destroyed by the cut-worm and other enemies, they are thinned out, so as to leave only two or three in a hill. Or, should they stand in rows or drills, the plants are left apart one or two feet. The operation of suckering takes place some time after thinning, and consists in tearing off the side-shoots which often sprout from the bottom of the main stalk. It is thought, however, by many, that this practice is more hurtful than beneficial, injuring

the growth and development of the corn, and lessening the product of both fodder and grain.

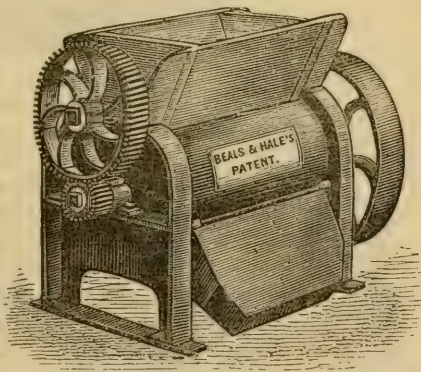
Harvesting the Crop.—This is done differently in different parts of the country. In the Northern and Eastern States and Pennsylvania, the corn is usually cut off at the surface of the ground, as soon as the grain has become glazed, or hard upon the outside, and, whilst the blades are still green, put immediately into shocks, and thus left some time standing in the field. The corn, after becoming sufficiently dry, is husked and cribbed, and the stalks, with all the attached fodder and husks, are used for provender. In the Southern and southerly portions of the Middle States, the corn is commonly husked in the field, the stalks having previously had the blades stripped below the ears, and the tops lopped off above the ears. When, therefore, the ear has been separated, the naked stalk is left standing with the husk, which is soon after eaten by the cattle. In some parts of the Western States, where the crops are extremely luxuriant, with the absence of facilities to get the grain to market, it is common to husk out and secure enough of the corn for family use, and then turn the hogs and cattle into the field, to consume the remainder. Cracked corn is obtained by means of the corn-cracker (Fig. 52), and is valuable in many cases.

By the first of these methods, the crop may be secured before the autumnal rains, with all its valuable fodder, and the ground cleared in time for a winter crop of wheat or rye. The juices retained by the stalk are sufficient to nourish the corn to maturity. By the second mode, there is always a loss in the grain product, which is never so well filled after the blades and tops have been removed in a green state.

Preserving Corn.—This is usually done by stowing away the ears, cleared from the husks, in small or narrow granaries, called cribs, the sides and ends of which are constructed of logs or laths, so as to leave spaces of about an inch, or more, for the circulation of air.

Fig. 53 is a corn-sheller, and Fig. 54 a corn and cob-crushing machine now much in use. The first-named (Reading's Patent,) will shell from four hundred to five hundred bushels of corn per day. The crusher is

Fig. 52.



used at the South and West for the purpose of cracking or crushing the corn and cob together.

Fig. 53.

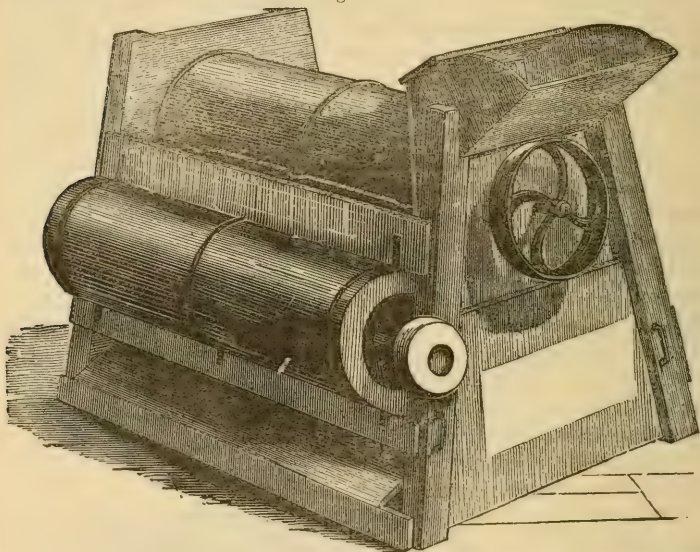
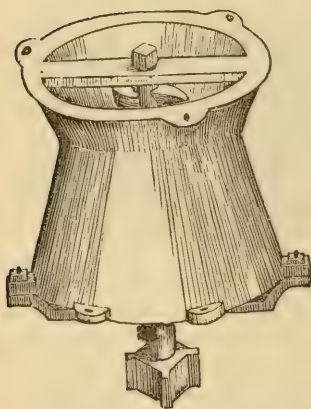


Fig. 54.



Diseases and Enemies.—Besides the birds, cut-worms, wire-worms, &c., that we have already alluded to, corn suffers from other diseases, the chief one being a dark or blue-black spongy growth, which sometimes takes the place of the blighted ear of corn. The mass sometimes grows until five or six inches in diameter, and is to be considered a luxuriant or rank species of fungus. As the species of what are called parasitic plants, to which this belongs, are so readily destroyed by applications of common salt, there is reason to believe that soaking the seeds well in salt water, previously to planting, or scattering salt over the grounds, will prevent this disease.

A reddish kind of rust sometimes appears on the leaves, but seldom does

much apparent injury to the ears, unless it becomes extensive. However, the same rust sometimes fixes upon the stalks, and causes them to decay. When this is near the ear, or the decay is extensive, the plant produces but little grain. The cause is attributed by some to bruises and wounds inflicted by inconsiderate cultivation, especially as the tassel, wrapped in its own leaves, may be seen formed in the plant when it is quite young. It sometimes happens, as the effect of storms, that the pollen is blown or beaten off the tassel before all the silk has protruded from the ear. The consequence of this is a failure in the development of grains in the extremity, or other portion where the silk was deficient. It has been urged, among the reasons for allowing the suckers to grow, that, being later in tasseling and less exposed to high winds, they assist to promote the process of fecundation after the tassels of the main stalks have shed their pollen. As an evidence of this, it has been stated that the earliest ears are always best covered with grain, while those which push late often exhibit a quarter or a half of naked cob, — the consequence of imperfect impregnation.

BUCKWHEAT.

Description. — This is the grain produced by the *Polygonum fagopyrum* (a), *tartaricum* (b), and a few other species.

Fig. 55.



Soils. — This plant thrives well on soils which are too poor for all other kinds of grain, either of the spring or summer varieties. It grows on dry, sandy soils, provided only that the drought be not felt precisely at the time

when the plant stands most in need of moisture ; it then yields as plentiful a crop as any other kind of grain ; but if the ground be in a situation somewhat more accessible to moisture, the crop is so much the more to be depended upon. It also thrives on heath and marsh lands, provided the latter have been previously drained. It is cultivated to great advantage on clearings of this description, and is very useful in preparing the soil for the reception of other kinds of grain. In sandy districts, buckwheat is the only crop which succeeds when sown alternately with rye ; in such situations, it takes the place of other fallow crops ; it is also sown on lands where rye has been grown. It, however, thrives better as a fallow crop on land which has been used as pasturage, or left in repose for a few years. On richer soils the plant grows more vigorously, but only in the stalk, rarely producing so much seed as when grown on proper soils. A small quantity of manure is advantageous to it, but a large quantity makes it grow too strong in the stem. When the land on which buckwheat is to be grown requires manuring, it is usual to give it only half the usual quantity, the remainder being reserved till after the harvest. Manure furnished by furz is particularly well adapted to this kind of grain.

Culture.—The sowing of buckwheat, even on the lightest soils, must always be preceded by two ploughings, in order to destroy the weeds. On account of its sensibility to cold,—the slightest hoar-frost injuring it,—the sowing must be deferred till all danger of cold nights is over. The middle of May is recommended ; and, if sown later, it is liable to be attacked by the white frosts of autumn, before its seed is ripe. The quantity of seed sown on a given extent of ground is about half of that used in sowing wheat ; sowing more thickly is injurious.

The success of buckwheat is considerably affected by the weather to which it is exposed in the several stages of its growth,—more so, perhaps, than any other grain. It requires dry weather immediately after sowing, and springs up during the time of the greatest drought ; but, after putting forth its third leaf, it requires rain, in order that its leaves may be developed before the appearance of the flower, which soon follows. During the long time for which it continues in flower, this plant requires alternate rain and sunshine to facilitate its growth and enable its flowers to set. The flowers drop off during thunder-storms, or even on the occurrence of electrical phenomena unaccompanied by rain. Violent easterly winds also cause it to wither before its flowers are set. After flowering, the plant again requires dry weather to bring all its seed to maturity at the same time, and insure an early harvest. The success of buckwheat is therefore somewhat precarious, depending not only on the general state of the weather throughout the season, but also on the time of sowing, a week earlier or later often

making a great difference. By sowing it in three or four different portions, at different times, a crop may be made sure of. The seed should be simply covered up with the harrow, and not in furrows, and requires no further attention than guarding it against the depredations of birds, to which it is very subject.

Harvesting. — The ripening of the grain is very unequal, for the plant is continually flowering and setting. It must, therefore, be cut at the time when the greatest quantity of grain is ripe. It sometimes happens that the first flowers do not set, or that they produce nothing but barren seeds, destitute of farina, while those which come out later yield better seed. But the grain will ripen, and even the flowers set, while the crop is lying on the ground after cutting, especially if rain fall. This occurrence is, therefore, considered favorable.

The produce of buckwheat is, therefore, uncertain. When it is sown after a corn crop, one good harvest may be expected in about seven years; in the same interval, three medium and three bad harvests may be expected. But when sown on land which has been left in repose, or laid down to grass for a few years, we may reckon upon one good crop out of two.

Uses. — Buckwheat furnishes an important article of food for man. As a fodder-plant, too, it is excellent, and, when cultivated for this purpose, may be depended upon as well as any other plant. It may either be given to cattle as green-meat, or else made into hay. It dries but slowly, but does not spoil when left on the ground without being turned. The cultivator who wishes to raise it for this latter purpose should choose a year in which the plant has been particularly successful, in order to obtain a good supply of seed; this, he will find, will yield him as good a return as any other. When raised for this use, it may be sown on the stubble of a corn crop, or, still better, after vetches which have been mown early in the season to be consumed as green-meat.

Another purpose to which buckwheat has been applied, and for which it appears, from the usual rapidity and exuberance of its growth, peculiarly adapted, is the ploughing down, to add fertility to the land. This can be done when the soil is too far exhausted to produce clover for a similar purpose. It is one of the most economical and convenient manures which the farmer can employ. A small quantity of seed, costing a mere trifle, sows a large surface, and gives a great crop. When in flower, first roll, and plough it in, and it will be soon converted into manure. This crop is recommended as an effectual destroyer of that frequent pest of the field, called couch-grass, quick-grass, &c. For this purpose it must be sown as early in the season as frost will permit, and, as soon as it gets into flower,

rolled down, and turned under with the plough. Another crop is then sown on top of the first, and harrowed in ; and, if the season be not unfavorable, it will ripen and afford a harvest before frost sets in

THE POTATO.

Propagating. — The potato may be propagated from its seeds, and it is in this way that new sorts are obtained ; or it may be propagated by planting the tubers, in which case plants similar to the old are produced. The approved practice is either to plant the tuber entire, or cut it into pieces, so that one eye shall be upon each, the tubers to be planted being those which were taken up before the stems had begun to decay in autumn.

Varieties. — The varieties of the potato are numerous, the most obvious distinctions being the early and the late. First : the earliest kind, used by gardeners, generally termed forced potatoes, and not intended for field-culture. Second : early kinds, which may be subdivided according to their order of ripening, as — the Early Shaw, American Early, Early Champion, and others, being the earliest sorts in cultivation ; the Early Red, Cape of Good Hope Kidney, and the Bread Fruit, an intermediate class. Third : the later kinds, forming the common subjects of cultivation in the field, such as the Red Apple, Bedfordshire Kidney, Lancashire Pink, and numerous others. Fourth : those of a large kind, but coarse, as the Late Champion, Ox Noble, and the Surinam. Fifth : the different varieties of Sweet Potato.

Soils. — The soils best adapted to the potato are of the drier and lighter class. In wet clays the return is inferior in quality and productiveness. Deep, dark peat, often produces large crops ; and it is one source of great value in this plant, that it can be cultivated successfully even on soils of a peaty character.

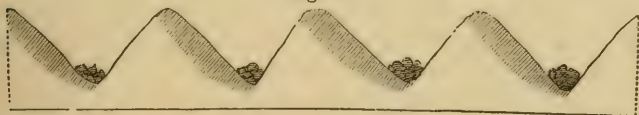
Culture and Tillage. — In the common course of farming, potatoes are cultivated by the plough, but they are frequently, also, and this, in many cases, with great convenience, cultivated by the spade ; thus, in woods in new countries, in plantations and steep banks inaccessible to the plough, or, in certain cases, in peat too soft to bear the treading of cattle, the spade may be beneficially substituted for the plough. Its cultivation, however, upon the larger scale of farm-culture, must necessarily be performed by the plough and the working cattle upon the farm.

The potato forms a good preparative crop for any of the cereal or eatable grains, and it may follow any crop of corn. Sometimes potatoes are planted upon land newly broken-up from grass ; in this way they may be cultivated beneficially in regard to produce ; it is, however, a deviation from the general rule, that the potato should follow a crop of corn and be succeeded

by one. As in the case of preparing land for the summer fallow, the land intended for potatoes is to be ploughed before winter, receiving a furrow of eight or nine inches in depth. The ploughing should be lengthwise, so as to keep the ridges dry, and prepare the ground for early tillage in the spring, at which time, as soon as the other labors of the farmer will allow, and the land is sufficiently dry, it is to be cross-ploughed, and harrowed by repeated double turns of the harrow in every direction. The roller also, if necessary, is to be employed to reduce the soil, and all the root-weeds are to be carefully collected by the hand, and carried away to be formed into a compost. The land is next to be ploughed in a direction crossing the last ploughing; or, rather, the ploughs may cross the field diagonally, because, as it is always desirable to make each alternate ploughing cross the previous one, and as the next ploughing which forms the drills will be in the direction of the former ridges, all the ploughings will thus be made to traverse each other. When this second ploughing is given, the land is to be again harrowed and rolled, if necessary, and all the root-weeds are to be industriously collected and removed as before.

The proper manure for the potato is common farm-yard dung, but any other putrescent manure that can be obtained may be applied. As soon as the dung is spread along the hollows of the drills, the potatoes are to be planted. The potato-sets should be cut ten or twelve days before planting them, by which the cut part acquires a skin or hard surface. The sets are placed directly upon the dung in the row, about ten inches from one another. The planters, carrying them in baskets, gently place them upon the dung, directed by the eye, as nearly as possible, at the distance required. A transverse section of the drills, with the dung and potato-sets placed upon it, will appear thus:—

Fig. 56.



The sets are now to be covered by splitting each drill so that the top of the new drill formed is immediately above the bottom of the old one, and this simple series of operations completes the planting of the potato. The usual period of planting is during the month of April, continued till the middle of May. The early potatoes should be planted earlier.

In a fortnight or more after planting, the whole field is to be harrowed. The effect of this tillage is to partially level the ground. When the plants have got above ground, and appear distinctly in rows, the horse-hoe is to

pass along each interval; and, following this, the hand-hoers, each with the common hoe, are to hoe the rows of plants carefully, cutting up all weeds &c. After an interval, as a fortnight or more, the horse-hoe, with side-coulters, is again to pass along the intervals. Immediately succeeding this, the hand-hoers are to follow as before. This is generally sufficient to clean the land in an effectual manner, though sometimes, when there are many weeds, a third hoeing may be necessary. The last operation is raising the earth to the stems of the plants. This is done by a double mould-board plough passing once along the intervals, and throwing up the earth towards each row. A transverse or cross section of the ground will then appear thus:—

Fig. 57.



This, in all cases, completes the culture of the potato, the crop requiring no further attention until the tubers are ready to be taken up, when ripe, which may be done with a three-pronged fork, shovel, or a plough with the coulter detached, in dry weather and before frost.

It has often been recommended to pinch off the blossoms of the late potatoes, so as to prevent the formation of seeds, and to obtain a greater crop.

Uses.—The starch or fecula of the potato may be obtained separately by simple means. It is perfectly nutritive, but does not undergo the panary or bread fermentation. It may be mixed with the flour of wheat in a given quantity, so as to produce good bread.

It may be given in its raw state to nearly all our domestic animals. It requires merely to be washed, which is done by various simple means. But although potatoes may be given to live stock in their raw state,—and it is frequently convenient to give them in that state,—yet various benefits may arise from giving them steamed or boiled, and in this state they are relished by every class of domestic animals, affording food in a high degree nourishing. Even the dog will fatten upon them. Steamed potatoes, mixed with cut straw or hay, may be given to horses of every kind; but it is observed that steamed food is not generally so good for ruminating as for

other animals. To hogs they are given with the best effect; also to poultry mixed with meal.

Diseases. — The chief diseases of the potato are the curl, the worm, and the scab. The curl is indicated by the curling of the leaves, and their consequent diminutive size. To avoid this, seed from newly reclaimed or mountain land must be used. Using unripe tubers is also said to be a preventative of the disease, and especially such as have not produced seeds.

The worms sometimes attack the tubers in the ground, and greatly injure them in certain situations; but they may be destroyed by spreading some salt on the ground before planting. The scab must be remedied by giving good tillage to the land.

Independently, however, of the curl, and every other known enemy, a very extraordinary failure has taken place, since 1832, in the potato crop, extending, in many cases, over entire districts, and, in others, partially confined to portions of particular fields. This is generally termed the potato rot, and will be found treated at length in Chapter XIII.

Potato-planter and Seed-drill. — This is a new labor-saving machine, consisting in the employment of an endless apron, placed beneath a hopper, and containing a series of cavities, by means of which potatoes of a proper size for seed are conveyed from the hopper to a discharge-spout, through which they fall into the furrow at regular intervals. Those potatoes which are too large for seed, are conveyed on the apron to a knife at the lower end of the hopper, by which they are cut to a suitable size. Thus, at one operation, the seed potato is cut, planted, and covered.

SWEET POTATO.

Description. — A perennial, low-creeping vine, the fine, tuberous roots of which are an esteemed esculent. Although a native of the Southern States, it flourishes also in the Middle States, but cannot be cultivated with profit north of the 41st degree of North Latitude. In the lower counties of New Jersey, in parts of Delaware, and in the Southern States, it attains its highest perfection, and is in great request as an article of food.

Varieties. — These are quite numerous, and chiefly distinguished by size and color, which latter ranges from a rich yellow to white and red. The weight varies from a few ounces to several pounds.

Soils. — The soils naturally adapted to the sweet potato are those of a light, mellow, sandy character; hence its large yield in New Jersey, and others of the seaboard States. It refuses to grow in heavy clay, or stiff loam soils.

Culture. — This plant was formerly propagated by setting the tubers

out in beds early in spring, whence they were subsequently transplanted to hills arranged at a distance of five or six feet apart, and the trailing-vines were not permitted to strike root. The great labor of planting and cultivating them in this mode, has, however, led many to abandon it, and resort to the ridge system of planting, which is thus managed. The ground must first be well broken up and harrowed, after which, with a plough, throw three furrows together to form a ridge, and finish up the ridges with a weeding-hoe, or fine rake, by drawing up the earth on both sides to about the usual height of potato hills. Then open a trench on the top of each ridge, drop in the slips five or six inches apart, and cover them with the soil to the depth of two inches. By this mode of planting, not only is less ground occupied, but less labor also is expended in its preparation, and in planting the roots. When the crop has matured, clear away the vines, and turn a furrow from both sides of the ridge, when the potatoes can be readily taken out with the hands, or by the use of the hoe.

Preservation of the Crop.—Place the roots in a dry cellar, the same day they are taken out of the ground, and cover them up close with chaff, or dry earth. During very severe freezing weather, close the windows of the cellar entirely.

GROUND PEANUT.

This legumine (the *Arachis Hypogæa* of naturalists) is very profitably cultivated in many of the Southern States. It succeeds best on light sandy soils, where it produces from twenty to forty bushels. It also furnishes a good lot of forage. It is sown in drills about four feet apart. Soon as possible after plants appear, they should be worked with a light plough. They quickly spread over the surface. The blossom is of a light yellow; and, singular in this respect, the seed pod grows into the earth, where the seed matures. When ripe a fork is used to loosen the soil, when they are hand picked, dried and stored under cover.

SUGAR-BEET.

Soil.—The sugar-beet requires a deep, rich mould, somewhat retentive of moisture, but yet not tenacious. Its richness should proceed less from the use of manure at the time of sowing, than from the effects of previous applications. The sweetness for which these beets are so much esteemed, depends in a great measure on the quality of the soil; those grown in poor, light soils, having usually an earthy taste. There are some lands in which the superior varieties will not attain their ordinary size, or even acquire a tolerable flavor, while in the same locality, inferior varieties will be produced, which have an excellent taste.

Culture.—Plant in rows, at a distance of two feet six inches from each other, and at intervals of twelve inches in the rows. Deep ploughing and pulverization of the soil are essential to the full development of the root. Put the seed in the ground during March or April, and carefully tend the plants during the early stages of their growth, clearing out all weeds, and thinning the plants where necessary. Moist weather is the most suitable for performing these operations, and a cultivator may be used with advantage.

MANUFACTURE OF SUGAR.—From the root of this variety of the beet, sugar of a very superior quality has been made in the United States; but, to insure its profitable production, the manufacture should be conducted on a large scale. In the extraction of sugar from the beet root, seven different processes are used, which we shall endeavor to describe. Before proceeding to do so we may here remark that besides the fact that beets are very much liked for their culinary uses, they are probably the most certain crop for feeding to stock that can be grown. The best cattle seen at Smith Field are so fattened.

Cleansing the roots.—This is done by washing them in long, wooden cylinders, having open sides, which, by the aid of steam-power, revolve rapidly in large cisterns filled with water. The roots are thrown in at one end of the cylinder, carried around a spiral screw, and ejected at the opposite end. This is, however, a very imperfect mode of cleaning them; for, if the roots have been grown in a stiff soil, large masses of earth will still be found adhering, which will not only prove injurious to the teeth of the crushing rasp, but will also lessen the value of the cake as food for cattle. The large roots being frequently hollow, and much decayed at the crown, the acid generated by this putrid matter injures the saccharine yield. Matter of this character cannot be removed by any process of washing; and nothing proves so effectual as the knife, with which all impurities may be scraped away, or cut off, those parts only being retained which will yield a superior quality of sugar. The ends of the tap-roots, as well as the lateral fibres, both of which are not only useless for the production of sugar, but positively injurious, should be excised, and fed to the cattle and hogs, which will greedily devour them, together with the scrapings of the roots.

Crushing or Rasping.—Except where maceration is practised, this operation is always performed by the aid of the rasp, which is a wooden cylinder, the outer circumference of which is armed with steel saws, placed transversely at a distance of half an inch apart. In width it is usually about thirteen and one-half inches, and in diameter about twenty-three inches. Driven by steam-power, these rasps make 900 revolutions

in a minute, and crush into a smooth pulp between 5000 and 6000 pounds of the root per hour.

Pressing the Pulp.—Instantaneous fermentation being a result of the heat engendered during the process of rasping, no time is lost in pressing the juice out of the pulp, which, as it falls from the rasp into a square box placed beneath, is removed by a deep wooden or copper shovel, and put into a bag. This is then conveyed to a wicker frame, placed upon a hand-barrow mounted on wheels, the pulp spread evenly in the bag, and the mouth of the latter doubled down, to prevent the escape of pulp when on the press. Over this is placed another wicker frame and another bag, until the pile contains thirty or forty bags and as many frames, when the whole is placed on a wooden platform, resting on the bed of a hydraulic press, and pressure applied. After the juice has all been extracted, the pressure is removed, the bags emptied of the dry cakes, and the press made ready for another load. A pair of these is always required, so that while one is in use, the other may be in preparation. The juice flows into a cistern constructed beneath the floor, whence it is at once pumped into a defecating pan, which is so placed that the contents may flow out through a pipe into the evaporator.

Defecation is conducted in a copper pan, to which, after it has been nearly filled with juice, heat is applied by means of fire or steam. At a temperature of 162° Fahrenheit, cream lime is added, in exact proportion to the amount of the contained acid, which is ascertained by chemical tests. The lime is intimately mixed with the juice, by stirring the solution with a wooden spatula, after which it is allowed to rest, and the heat raised to the boiling-point, when the ebullition is suddenly checked by shutting off the heat. When the juice has settled, and become clear, it is drained off into the first evaporator,—the scum and sediment being carefully excluded. These are subsequently poured into bags and pressed, to extract the juice contained in them, after which the residue forms a valuable addition to the dung-heap.

Evaporation.—The clear, defecated liquor flows into a copper pan, called the evaporator, until it is about one-third full, when a small quantity of animal charcoal is added, and heat applied. If the juice threatens to overflow the pan during the process of boiling, the addition of a small quantity of tallow causes its immediate subsidence, and facilitates evaporation.

Clarifying.—This is done in copper pans, thirty inches deep, twenty inches in diameter near the top, and eleven inches in diameter near the bottom; each one being furnished with a small brass spigot at the lower end. A copper strainer, supported on three feet, and covered with can

vass, fits into each clarifier near the bottom, and on this about one hundred pounds of powdered animal charcoal is placed. This is covered by another copper strainer and cloth, on which the sugar is permitted to flow until the pan is filled. After an interval of some time, the discharge spigot is opened, and the syrup allowed to flow out slowly into a cistern, from which it is pumped up into the condenser for a final evaporation. The pans are carefully refilled as rapidly as they are emptied. Twice each day the charcoal is thrown out of the clarifiers, and replaced by fresh coal from the kilns. As some of the saccharine matter remains in the carbon, the latter is then used to receive the juice from the defecator as it passes into the first evaporator, and the sugar thus extracted. The charcoal is then washed, and again calcined for future use.

Concentration.—After the clarified syrup has been evaporated in the condenser until it marks 41° on the saccharometer, its fitness for crystallization is tested by drawing some of it out between the finger and thumb. If the thread breaks, and the end draws up towards the finger in a hard mass, it is ready for the purpose. Sometimes it is tested by blowing a portion of the syrup through the holes of a skimmer, when, if it be sufficiently tenacious to form air-bubbles, which, on falling to the ground, burst, and crumble into a white powder, the fire is immediately withdrawn, and the syrup drained off into large coppers, placed in the air, where it is allowed to cool for about two hours, during which time it is occasionally stirred to promote a thorough and regular cooling of the whole mass. It is then run off into flat pans, made of tinned iron, in which it is left to crystallize, in a cool situation, for twelve hours, or even longer. These pans are subsequently removed to a stove, in which they are stood on end, to allow the molasses to drain off; and, in about twelve days from the first operation, the sugar is ready for a market. About one-tenth of the contents of each pan being saturated with molasses, this portion is separated from the rest of the cake, mixed with the molasses which has drained from the pans, reduced with water to 17° of the saccharometer, evaporated to 21° , and again subjected to the clarifying process. Being then concentrated to 41° , it furnishes second quality sugar, which, if well made, equals that of the first quality for refining purposes. When sufficiently concentrated for crystallizing, this second quality syrup is poured into the coolers, whence it is removed to cone-shaped earthen pots, in which it is allowed to cool for a time, and subsequently placed in a stove. In twenty-four hours the stoppers are withdrawn from the pots, and the molasses allowed to drain off. Six weeks afterwards this sugar is ready for market. When the loaves of sugar are taken out of the moulds, the apex of each is found to contain a considerable quantity

of molasses. These portions are broken off, reduced by water, and treated as before described. All the scum which rises during the boiling process is carefully removed, and washed with water, to obtain from it all the contained sugar; and this water being again used to reduce the impure sugar from the pans, nothing is lost.

Proportions of Lime used.—At the commencement of the sugar-making season, when the roots are fresh and good, 4 pounds of lime are sufficient for the defecation of 225 gallons of syrup; but, as the season advances, more lime is required, until, at length, when vegetation has commenced, 7, and even as much as 8 pounds are necessary for the purpose. There is then danger of an excess of lime, which is usually taken up by an acid, added when the syrup is undergoing the final condensation. Sulphuric acid, reduced by water, in the proportion of 44 parts of water to 1 of acid, is used for this purpose—the precise quantity being ascertained by chemical tests. If a greater quantity is added than is requisite to neutralize the excess of lime, the sugar is objected to by the refiners, as its use subjects them to much inconvenience and some loss.

SUGAR-CANE.

Description.—The sugar-cane (*Saccharum officinarum*,) is a perennial-rooted plant, very susceptible to cold, and consequently restricted in its cultivation to the zone between 35° and 40° on each side of the Equator. In the United States, its cultivation cannot be advantageously pursued

Fig. 58.



higher up than about the 32d degree of North Latitude, and the cane here dies down annually, unless cut before frost sets in. Like the bamboc

and Indian corn, the sugar-cane belongs to the family of the grasses. It attains the height of from six to twelve feet, and is surmounted by a terminal panicle, one to three feet long, of a grayish color. This hue is derived from the long, soft hairs, surrounding the flower, which, with the lengthy, broad leaves, impart to the plant a beautiful appearance. The stems, filled with a spongy pith, are very smooth and shining, and the flowers, which are small and very abundant, are covered externally with the before-mentioned silken hairs. It flowers in the West Indies after the lapse of a year, though rarely; but never in Louisiana; consequently the seed can seldom be procured, except by importation from Otaheite or China. The development of seed interferes with the production of saccharine matter.

Varieties.—Several varieties of cane are grown in Louisiana and the West Indies—the *Otaheite*, the *Brazilian* or *Creole*, the *Bourbon*, the *Red Ribbon*, the *Blue Ribbon*, the *Yellow Ribbon* or *Java*, the *Green Ribbon*, and the *Grey*. The two first are most extensively cultivated in the West Indies, while the others are confined to the sugar districts of the Southern States. The *Red Ribbon* is best suited to the climate, all the others being readily affected by cold; but it degenerates very rapidly. In Louisiana the sugar-canes “ratoon,” that is, produce a new growth from the roots, for two or three years in succession; but the planting must be renewed every two or three years, though in the West Indies, where a similar course of ratooning is pursued, a plantation lasts from six to ten years.

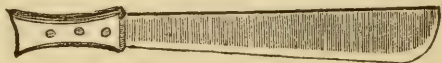
Soil.—A rich alluvion seems best adapted to the sugar-cane, and it is grown on both the *red* and *black* lands of the Island of Cuba. The former appears to be composed of coral reef, in a disintegrated state, mixed with vegetable carbon and oxide of iron, which imparts to it the red hue. The latter, a rich black mould, evidently of vegetable origin, and probably the remains of old swamps, produces canes of a very superior character, which yield a better sugar than those grown on the red soil. It is a very exhausting crop, and the rich lands of Louisiana have become so much exhausted by a continuous cultivation of sugar-cane, that they are only kept in tolerable condition by the application of costly fertilizing compounds. The adoption of a judicious system of rotation would have prevented this result, and must yet be resorted to as the only means of reclaiming the land, and restoring it to its original fertility.

Planting and Ratooning.—In Louisiana, as also in the West Indies, new canes are not planted every year, as, owing to the absence of frosts in the latter region, and the usual mildness of the winter in the former, the roots retain their vitality for years, and continue to produce canes equally as good as those cut from the first planting. This system of

culture is commonly designated "rattooning." In making selection of plants from which to make cuttings, those with healthy, succulent tops, are preferable to the hard, woody ones, and much benefit is derived from exchanging cuttings with neighboring plantations. In renewing a field, the canes are usually planted in rows—a space of six feet in width being left between each row. A series of holes is made in the ground in a direct line, in each of which two joints of cane are deposited, and the earth loosely drawn over them. Two are planted in each position, to guard against the possibility of one failing to germinate. Beyond an occasional hoeing, the sugar-cane requires but very trifling attention.

Securing the Crop.—Seizing the canes with their left hands, the operators draw them forward, and, with a single blow of their *machètes*, or

Fig. 59.



cane-knives, cut them off close to the root. Then stripping them of their leaves, they divide them into two or three pieces, and throw them aside to be collected by the women and children, who load them into the carts which carry them to the mill.

Crushing the Cane.—When a sufficient number of canes have been cut to supply juice enough to fill all the kettles and clarifiers, the process of manufacture is commenced by crushing the canes between powerful rollers, to which they are fed by an endless series of slats. The juice flows into a pan placed beneath the mill, whence it is conveyed to the clarifiers, or pumped up into a receiver, and distributed where required. After passing through the mill, the crushed canes are conveyed away by another endless apron, from which they are taken, and spread in the sun to dry. When properly cured, they are stowed away in sheds, and furnish a supply of fuel for the succeeding year.

Testing the Strength of the Juice.—A quantity of the juice, as it flows from the mill, having been collected in a copper vessel called a "test-dipper," the "saccharometer" is plunged into it, and the height at which it floats carefully noted. The saccharometer is a hollow tube, with a bulb at one end, loaded with shot, to keep it in an upright position. It has a scale of degrees marked on it, rising from 0° up to 50°, and, when placed in pure water, it stands at 0° of the scale. As each degree marks 19 parts in 1000 of the solution to be tested, if, when plunged in the juice, the saccharometer indicates 10°, the contained sugar may be known.

to equal 19 per cent., and so in proportion for each additional degree. If the juice is thin, it will mark the same on the saccharometer, either in the hot or cold state; but, as a cold syrup will mark more than one which is hot, it is necessary to add three degrees for the hot syrup, in order to ascertain its density after it has cooled. Four degrees must be added for syrup containing molasses. When recently expressed, cane juice is opaque, frothy, of a yellowish-green, and sometimes of a greyish color, and consists of two parts, easily separated by filtration—one being a perfectly transparent fluid, of a pale yellow color; the other a dark green fecula, which rises upon the boiling liquid in the form of scum. The specific gravity of the juice usually fluctuates between 10° and 15° Baumé; and this difference in density depends on the age of the cane, the climate in which it is grown, the nature of the soil, the character of the season, the temperature of the atmosphere, etc.

Defecation.—This operation is conducted in pans, placed over flues so arranged that the heat can be shut off from one of the pans without interfering with the others. As soon as the receiving-tank is full, the juice is conveyed into the defecating pans by a wooden gutter, and, when slightly warm, a sufficient amount of cream of lime is added to neutralize the free acid, and to assist in coagulating the vegetable albumen contained in the solution. With the increase of heat all the impurities rise to the surface in the form of a thick, dirty crust, leaving the clear juice below. On the first appearance of ebullition the dampers are closed, and the juice allowed to stand about twenty minutes, when it is drawn off from the bottom, and conveyed to the first clarifier; after which the defecator is cleansed, preparatory to receiving another charge. When a sugar-boiling train is in full operation, one defecator is always full while the other is being cleansed.

Clarifying.—This process is conducted in two iron pans, lined with sheet copper, which are placed much nearer the fire, but higher up than the defecators. They are both in a line with the flue; but the first, which is the largest, and most remote from the fire, is placed about two inches lower down than the second. Both pans being surrounded by a gutter, whatever overflows from the second during ebullition finds its way back into the first, and all the impurities which escaped removal in the defecators, and which are skimmed from the boiling liquid in the clarifiers, pass through an opening at one side of the gutter into a scum-kettle, placed alongside of the train. As soon as it settles, all the good syrup is again returned to the first clarifier by the aid of a pump, with which the scum-kettle is furnished. The juice, after being thoroughly purified in the clarifiers, is next conveyed to the evaporators.

Evaporators. — These are also two in number, the first being the largest, and placed next to the second clarifier. The smallest, which is directly over the furnace, is called the “teach.” Both these pans are surrounded by a copper curb — that around the smallest pan being the highest. This prevents the syrup from the first evaporator boiling over into the second, while at the same time it allows the overflow from the “teach” to find its way back into the first evaporator. The ebullition being most violent in the “teach,” owing to its position directly over the fire, its contents are reduced very rapidly; but it is continually replenished with syrup bailed from the first evaporator, which is supplied in turn from the second clarifier, that from the first, and the first from the defecators. When the “teach” is filled with a rich golden-colored fluid, which has ceased to froth, and from which the steam escapes in short puffs, the sugar-master tests its condition by taking a little of the syrup between his finger and thumb, and drawing it out in the form of a string. If sufficiently boiled to “strike,” the fire is withdrawn, and the syrup bailed into a gutter, by which it is conveyed to the coolers, distant about ten feet from the “teach.”

The Coolers are oblong troughs, usually about ten feet in length, five in breadth, and twelve inches deep, made of two-inch pine-boards. They are arranged in a double row, parallel with the train, and each has sufficient capacity for three “strikes,” all of which are not run into one cooler consecutively, but into three coolers alternately, until that number are filled, when three more are brought into use. While cooling, the sugar is agitated with a small wooden rake, which is drawn through the mass once after each “strike.” This promotes crystallization, and in a few hours the sugar sets or grains. A few days subsequently the sugar is dug out of the coolers, and carried in tubs to the purging-house, where it is emptied into hogsheads, the bottoms of which are perforated, to allow the molasses to drain away.

Purging. — When the sugar enters the purging-house, it is a dark brown mass, containing about forty per cent. of molasses; but, if the house be even moderately warm, this soon commences to drip into a tank placed beneath the open joists upon which the hogsheads rest. As the sugar settles down, the hogsheads are replenished, either with sugar which has already been purged, or with fresh material from the coolers. At the expiration of a month, or thereabouts, the hogsheads are headed up, and stored, or sent off to the place of shipment.

Clayed Sugars, requiring a different process for their purification, are produced in the following manner: The floor of the purging-house is covered with boards, pierced with holes sufficiently large to receive, and

hold upright, conical moulds made of clay or metal, each having an aperture at the small end. These holes are stopped with a plug of wood or cane, and the moulds filled with sugar which has been boiled to a greater consistency than that intended for the coolers, and then agitated for some time in a wooden box, to facilitate its cooling, and promote the formation of crystals. Each mould will contain between eighty and one hundred and twenty pounds of hot sugar. When the contents of the moulds are well crystallized, the plugs are removed, and the molasses allowed to flow out. This operation is much forwarded by pouring over the sugar in each mould a thin, creamy paste, made of porous clay, diluted with water, which has the effect of washing the crystals of sugar, by the percolation through them of the water from the clay, while the latter remains on top in a solid mass, which may be removed without injury to the sugar, after it has parted with all the water. This operation may be repeated several times, but at the expense of the quantity of sugar, which is washed away in proportion as it is purified. When removed from the moulds, three kinds of sugar are comprised in each loaf: a mixture of sugar and molasses at the apex of the cone, next brown, then yellow, and, at the base, white sugar. These different grades of sugar are separated, and either crushed between rollers, or pounded into fragments with a mallet, preparatory to being dried over a fire, or in the sun. It is then ready for market, and is the sugar commonly used by refiners.

Boiling by steam is now practised on many plantations, and has several advantages over the old process, though much more costly. Vaporization is conducted more rapidly by this method, and the color of the sugar produced is much lighter, whilst all danger of overheating is obviated. Steam is applied, either by coils of pipe, or by a series of tubes, through which it operates on the bottoms of the pans.

Boiling in vacuo, the apparatus for which was invented many years since by Lord Howard, is a more complicated and more expensive process than boiling by steam. The apparatus is merely a closed metallic vessel, from which the air and condensed steam are discharged by pumps as fast as generated by the heat beneath. As water boils in a vacuum at 90°, it follows that the low temperature at which water can thus be discharged from solutions of sugar, materially assists in preserving the color of the product, and as granulation will take place to some extent in the vacuum pan, if the process be properly conducted, the sugar when discharged will be full of grain, and soon become solid at a slightly lower temperature.

Yield.—From 3000 to 6000 pounds of sugar have been produced per acre in the West Indies; though in Louisiana about 1000 pounds is con-

sidered an average crop, with 20 gallons of molasses. The crop has, of late, considerably diminished, owing, it is thought, to the exhaustion of the old seed-stock, and efforts are being made to introduce new cuttings from the West Indies and South America. The real cause is, most probably, the continual cropping to which the land has been subjected for a long period, and new canes will not restore vitality to an exhausted soil.

Chemical Components of Sugar.—Modern chemistry has developed the fact, that there is very little difference between the components of sugar and those of many other substances which it is totally unlike—as starch, saw-dust, linen rags, &c. Water and carbon, the principal constituents of sugar, are found united in the like proportions in all these substances; and an eminent chemist, some time since, procured an ounce of sugar from a pound of linen rags.

CHINESE SUGAR-CANE, OR SORGHO.

Description.—The Chinese sugar-cane (by some botanists classified as the *Holcus saccharatus*, and by others as the *Sorghum saccharatum*,)

Fig. 60.



shoots up a long, straight stalk, interspersed with knots, from which spring, alternately, long, wide, tapering leaves, which curve gracefully downward at the ends. The stalk tapers gradually from the base upward, and is covered with a very smooth coating, resembling somewhat that of Indian corn, which becomes harder with age. It flowers in a panicle at

the top, changing from green, the primary color, to successive shades of violet, and finally to purple. The seeds, which at first are merely soft, green husks, fill with farinaceous matter as they mature, and become plump and hard. The stem varies in altitude under different circumstances, and, in a deep, black loam, reaches the height of sixteen feet; but, on the poorer soils, it ranges from six feet upward. The root, which is very strong and hard, in an open, porous soil, sends down its fibres to a great depth. The entire plant very much resembles broom corn in the early stages of its growth, and cannot readily be distinguished from it except by experienced persons. It endures cold much better than Indian corn, and does not sustain injury from the ordinary autumnal frosts.

Soil and Climate.—These very nearly correspond with those adapted to the growth of Indian corn, and the sorgho grows luxuriantly in rich bottom lands, or in moist loamy soils, well manured. Experiments made in Algeria, France, and the United States, have, however, demonstrated that the best results are obtained on loose, deep soils, of a sandy character, so situated that they can be irrigated at pleasure. Irrigation should only be practised during the early stages of growth, and when the cane is most rapidly developing, as, at a later period, it proves deleterious by impeding the elaboration of saccharine matter, and increasing the percentage of water. It will also produce a fair crop on dry, gravel soils, too poor to yield a remunerative crop of other plants.

Culture.—Plough deep, and harrow the ground carefully, so as to break up and pulverize all the clods. Subsoil ploughing is very beneficial, as the soil is thus loosened to a considerable depth, and allows the delicate radicles of the growing plant to descend through the interstices. When the ground has been properly broken up, prepare the seed for planting by soaking it for twenty-four hours in tepid water, to which saltpetre has been added in moderate quantity; seeds deprived of the hulls germinating in much less time than those sown with the hulls on. In northern latitudes, the saving of four or five days in spring is a matter of considerable importance to a plant of such slow growth as the sorgho. Sow the seed in rows, about the same time as Indian corn. Let the rows be four feet apart, and leave an interval of eighteen inches or two feet between the plants in the rows. One seed is sufficient to deposit in each place, as each one sends up several shoots, or seed-bearing stems. Cover them lightly with earth; and, after the plants have attained the height of twelve or fourteen inches, turn up a furrow against them with the plough, after which, use the hoe frequently to keep them clear of weeds. If cultivated with the view of obtaining the seed, or for the purpose of extracting the

sugar, the sorgho is planted in hills, like Indian corn ; but, if it is intended for fodder, a larger yield is obtained by resorting to the drill-system. One quart of seed will suffice for an acre, planted according to the first-named system ; but a much larger quantity will be required for the last. Fifty to sixty bushels of seed have been obtained from a single acre of canes, and between nine and ten tons of dry fodder. During the first few weeks after it is planted, the sorgho makes but little progress, except in penetrating the soil with its roots ; but it usually matures in ninety days, and, at farthest, in one hundred and twenty.

Uses as a Fodder Plant.—When grown for fodder, two and three cuttings may be obtained from it— the first being made just before the period of blossoming. The plant immediately sends up new shoots, its leaves are renewed, and its flowering panicles expand with great rapidity. This is a property also possessed by Indian corn, but in a much more limited degree. Though the milk of cows fed upon it is measurably decreased, yet the quality is greatly improved, and the animals gain in flesh. Fed to cattle in the green state, it does not produce those symptoms of flatulency frequently resulting from the use of green corn or succulent clover. The plant in its natural state is a wholesome and nutritious food for animals ; yet, after the sugar has been extracted from it, it proves positively injurious. Nothing being then left but the indigestible woody fibre, it collects in large masses in the stomach, ultimately causing the death of the beast which has unguardedly been fed upon it.

Curing the Fodder and Saving the Seed. — Cut the stalks in the morning, after the dew has evaporated ; and after they have sufficiently dried on the ground, tie them up in bundles, shock them up in the field, and let them stand thus for some time before stacking them or putting them in the barn. In whatever situation they are finally placed, a free circulation of air must be secured through the whole mass, to prevent it from heating. If grown for the seed, and to make sugar, one set of hands should strip off the leaves, a second set follow after, and cut off the seed-top, with one or two feet of the stalk, while a third set cut up the cane close to the ground, and throw it into piles, to be conveyed to the crusher. The seed-heads, after being made up into small bundles, must be hung up in a dry place, until an opportunity offers for stripping the seed, which can be done with the machine used for broom-corn. The coloring matter contained in the hulls of the seed is so easy of separation that the tissues of the poultry fed on it assume a purple color, and their excrements are dyed of the same hue. This coloring matter, which is tasteless and innoxious, may possibly hereafter prove useful in the

arts. The flour made from the grain has a violet hue, which disappears when carefully bolted, but again becomes apparent when manufactured into bread, which, however, digests very well, and is pleasant to the taste.

Making Sugar on a small scale.—Cut the canes just after a hard frost, as they will then yield a larger per centage of sugar. Remove the upper joints, as they contain but little sugar, though they will furnish good

Fig. 61.



molasses. The stalks should be passed through a crusher (Fig. 61) several times, in order to completely express all the contained juice. As the juice comes from the mill, filter it through a blanket, for the purpose of removing the fibrous matters, cellulose, and starch; then add a sufficiency of cream lime to render it slightly alkaline, which may be

ascertained by testing it with litmus paper. Boil the juice until a thick green scum rises to the top, which must be removed with a skimmer, and the liquid again filtered. Then boil the solution rapidly until it has lost half its bulk, when the fire must be diminished, and the syrup constantly stirred, to prevent it from burning at the bottom. After it has attained the consistence of ordinary sugar-house molasses, which may be known by taking a spoonful out and allowing it to cool, the syrup may be drawn off into tubs, and left to granulate, which will usually occur in three or four days. The syrup may be clarified by the addition of one ounce of bone-black to each gallon of the solution, and boiling the whole together. Filtration will then exhibit a syrup which is nearly colorless: the sugar made from which will be of a very light brown color, but may be whitened by the method described under the head of Sugar-Cane. When bone-black is not used, the sugar, after granulating, may be put into conical bags, made of very coarse canvass, and suspended over shallow vessels in a room where the temperature ranges between 85° and 90° Fahr. In a week or ten days the bags will be found to contain good brown sugar. Dissolve this in hot water, and to every 100 pounds of sugar add the white of one egg mixed with cold water. Boil for half an hour, skim carefully, and filter, to remove the coagulated albumen. For the manufacture of sugar on a large scale, the general process is the same as that pursued in the extraction of sugar from the West India cane.

Alcohol is also produced from the sorgho, by fermentation and distillation in the usual way. By crushing the seed and stalks together, a double yield may be secured; for, on maceration with hot water, the heat acts upon the starch contained in the grain, and transforms it into sugar, while the residue of the juice from the canes will produce good alcohol.

Vinegar.—The raw sap of the sorgho, like all saccharine juices, will rapidly take on the acetous fermentation, and furnishes a very superior vinegar. For this purpose, bruise the stalks in a mill, throw them into a quantity of water sufficient to cover them a few inches, and let them ferment at leisure. The vinegar must be racked off once or twice, to remove from it all foreign substances.

AFRICAN SUGAR-CANE, OR IMPHEE.

Description.—This plant, similar in appearance and general character to the sorgho, was discovered in the Island of Natal, in the year 1854, by Mr. Leonard Wray, through whose instrumentality it has been intro-

duced into the United States. Under favorable circumstances, one acre of the cane, will yield about 4000 pounds of dry sugar; and, if the plants are permitted to mature their seed, twenty bushels of grain may be gathered from one acre. This grain makes excellent flour, and may either be so used, or be fed to cattle and poultry.

Varieties.—Fifteen different varieties have already been noted by Mr. Wray, who thinks there are yet many more. Planted in a rich, alluvial soil, the largest attains a height of ten or fifteen feet, and requires from four to five months to mature. The seed-head, which is of considerable size, contains many thousand seeds, of a sandy-yellow color, and generally measures from twelve to eighteen inches in length. By the aid of very imperfect machinery, sixty per cent. of juice has been obtained from the stalks, yielding fourteen per cent. of sugar, fully equal to the best West India cane sugar.

Soil.—The Imphee will flourish in almost any soil, but arrives at greatest perfection in a rich alluvion, or in a loamy soil, containing a tolerably large admixture of vegetable mould. The latter description of soil, strong heat, and considerable moisture, are deemed essential to the proper development of the plant, and the plentiful production of its saccharine matter. The occurrence of dry weather a short time previous to its maturity, not only materially increases the yield of juice, but also the amount of sugar. The use of animal manures, salines, and ammonia, is considered to be injurious, because, though tending to the formation of larger plants, they render the juice so mucilaginous and saline, as totally to unfit it for the manufacture of sugar.

Rattooning.—In a warm climate, a crop of rattoons will be produced in six or seven months from the period of planting the seed, thus doubling the yield in that space of time.

Culture.—To expedite the germination of the seed, soak them in warm water twenty-four hours before planting; then, having marked off the land into rows at a distance of three feet apart, plant the seed at intervals of twelve inches in the rows. This distance should never be lessened, but rather increased, as each seed will send up from ten to twenty stalks, forming a large stool, which occupies considerable space. Keep the plants free from weeds by the use of the cultivator, and turn a furrow against the roots as soon as the plants have attained a sufficient height.

Uses.—Imphee can be made available for all the purposes for which sorgho is used, and the experiments which have been made with it in the United States, would seem to indicate a larger yield of sugar from it than can be obtained from the sorgho.

THE COTTON PLANT.

Description.—The cotton plant (the generic name of which is *Gossypium*,) ordinarily grows to the height of five feet, though it sometimes in

Fig. 62.



very fertile soils, attains double that altitude. In general appearance it somewhat resembles the okra plant, but it is more branching; and the leaves, which are hoary and palmate, with sub-lanceolate, and rather acute-lobes, are smaller, as well as of more uniform shape. The long and jointed branches are occasionally bifurcated, and at each joint bear a boll or capsule, containing the wool and seed. The filamentous substance, called cotton, consists of tubular hairs which arise from the surface of the seed-coat. They become flattened by drying; and if, while in this state, they be immersed in water, and examined by the aid of a microscope, they exhibit the appearance of distinct, flat, narrow ribands, with occasional joints. Each boll is accompanied by a broad, indented leaf, which springs from the same joint, and rests upon a foot-stalk three or four inches in length. The blossom, which is two or three inches long, and cup-shaped, is white during the first day after its appearance, but gradually becomes red. It closes slowly, and is soon after detached by the growth of the young boll, when it withers and is cast off, leaving the boll enclosed in a capacious calyx, having three divisions, with serrated margins. The woody part of the plant, which is white, brittle, and spongy, is covered with a thick, brown, pliable, and tough bark. The root, which is tuberous, penetrates deeply into the soil, and, as a consequence, the plant is much less affected by drought than many others.

Varieties.—The different varieties of *Gossypium* may be classed under four distinct species: *Gossypium indicum*, or *herbaceum*, indigenous in

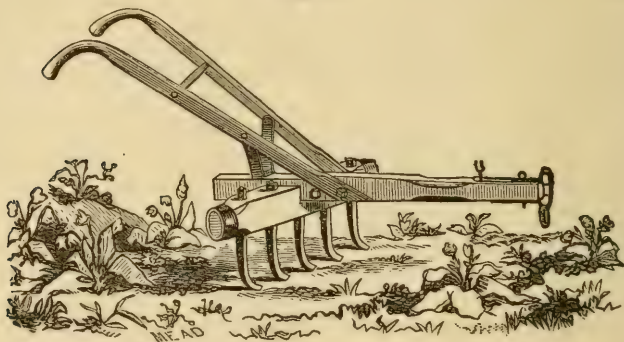
China, India, Arabia, Persia, Asia Minor, and some parts of Africa. 2. *Gossypium arboreum*, a tree-cotton, indigenous to India. 3. *Gossypium barbadense*, the Mexican or West India cotton, of which the Sea Island, Upland, and New Orleans are varieties. 4. *Gossypium Peruvianum*, or *accuminatum*, yielding the Peruvian, Pernambuco, Maranhão, and Brazilian cotton, and especially distinguished by its black seeds, which adhere together very firmly. The principal varieties cultivated in the United States are the Sea Island (*G. arboreum*), known as the "long staple," from its fine, white, silky appearance, and long fibres; the green seed (*G. herbaceum*), or "short staple," known in commerce by the name of upland cotton; and two kinds of Nankin or yellow (*G. barbadense*)—the Mexican and Petit Gulf. Beside the varieties above enumerated, three others are classified by botanists: *G. vitifolium*, or vine-leaved cotton; *G. hirsutum*, or hairy cotton; and *G. religiosum*, or spotted-bark cotton.

Soil.—The best cotton lands are those having a deep, soft mould, which may be readily penetrated by the rays of the sun. These imbibe with facility the stimulating gases abounding in the atmosphere, and allow all excesses of moisture to sink so deep beneath the surface, as to be in a position to do no injury to the delicate roots of the young plants. Land which is sandy and spongy, equally with that of a hard, close, and retentive character, is entirely unsuited to the proper perfection of the cotton plant.

Culture.—Cotton is most successfully cultivated in the lower parts of Georgia, Alabama, Mississippi, Louisiana, and in Texas. The winter is usually mild in these States, with very slight frosts; and the summer, though hot, is tempered by the sea breeze, which prevails during a great part of each day. Various systems of planting are followed in the cotton-growing States, but that most generally adopted is the ridge. The land, after being properly ploughed and harrowed, is thrown into ridges about four or five feet apart, from centre to centre; and a furrow being run in the middle of each, the seed is deposited at intervals, varying, under different circumstances, from six to twenty-four inches, and pressed into the loose soil with the foot. In rich river grounds, the rows are frequently six feet apart, and the plants distant three feet from each other in the rows. Planting generally commences about the 15th of March, and the proportion of seed sown is about one bushel to the acre, which leaves a margin for accidents by worms and otherwise. When the plants come up they are carefully weeded, and the cultivator or a harrow run through them to keep down the growth of grass. The harrow illustrated in Fig. 63 is useful in keeping the ground open, and clear

of weeds. A light furrow is then turned against the plants, to cover up and effectually destroy the young grass which has escaped the hoe. In

Fig. 63.



rough ground, where there is danger of covering up the plants with the plough, hoes follow after, to remedy any mischief which may have been done. As soon as the plants have acquired sufficient strength to withstand drought and defy the worm, they are carefully thinned out by hand, only the strongest and most likely being allowed to stand. The general rule is, to keep the earth loose and well stirred; working deep and close at first, but more shallow and remote as the crop approaches maturity. It is of importance to work the ground late, and cultivation never ceases until the branches of the plants interlock with each other. Ten hands are considered enough to cultivate 100 acres of cotton with ease; but a good crop requires at least twenty hands to pick it. Some planters top their cotton, while others never do so. Whether the practice is beneficial or otherwise, has not yet been decided—no observations having been made as to the practical result. Interchangeable husbandry is required by no plant more than cotton, and nowhere is it more essential than in the Southern States, where continual cultivation during the dry weather of spring and summer, conjoined with the rapid growth of the plant, break up the soil, and leave it in a condition to be washed away by the first violent autumnal rains. Rotation with cereals is, however, productive of no good, as the latter require, in a great measure, the same kind of food from the soil; and hence soils which fail to produce cotton, are alike incapable of growing grain crops. Judicious green fallowing is the easiest as well as the cheapest mode, not only of renovating, but also of preserving cotton lands in good condition. Fields

intended for fallow should be ploughed as deeply as possible in mid-winter, and all descriptions of stock should be carefully excluded from them. In spring sow them with turnip seed, and, when the leaves of the young plants are fully formed, turn them under with the plough, and sow a second time. Three or four crops may thus be ploughed in during one season, greatly to the benefit of the land, as by the decomposition of vegetable matter carbonic acid is produced, which is a powerful solvent of phosphated alkalies; and, by the turning under of those grasses and weeds not readily decomposable, a degree of friability is imparted to the soil which will enable it to profit from atmospheric action.

Manures.—As the cotton plant draws upon the soil for a very large amount of the phosphates, potash, and lime, the manure applied should be such as will return to the earth the same kind of material. Cotton seed contains all these substances in large quantity; but, as a sufficiency is not produced for the purpose, other articles must necessarily be brought into use. The refuse of manufactories will supply the potash, while bone-dust will furnish the phosphates, and Peruvian guano the nitrogenous compounds. Every planter, however, has the ability to supply from his own plantation a large portion of the manure necessary for the sustenance of his crops, and this he may do with very little trouble. Instead of hauling the stalks from the corn and cotton-fields into the barn-yard, they may be more profitably ploughed under at once, thus allowing their elements to return immediately to the soil, without being subjected to loss from evaporation. Their place in the compost-heap may be supplied by litter, leaves from the forest, grasses, weeds, and muck from neighboring marshes, as well as from the ditches and fence-rows on the plantation. Weeds abound in alkalies, and therefore furnish profitable vegetable matter, while muck and peat, being decayed vegetable matter in mass, in this concentrated form contain a large amount of phosphates and alkalies, which, when mingled with the droppings of animals, form a highly valuable compost. The compost-heap must be well protected from the weather, or the soluble salts will be washed out by the rains, and evaporated by the heat of the sun. Wood-ashes form an excellent manure, and gypsum may be used with success on cotton lands distant from the sea.

Picking.—The boles of cotton mature and open about the last of August, or during the first week in September, when the operation of picking commences. This work is done both by male and female hands, each one being provided with a bag, slung over the neck and shoulders, into which the cotton is put as fast as it is gathered. Large osnaburg

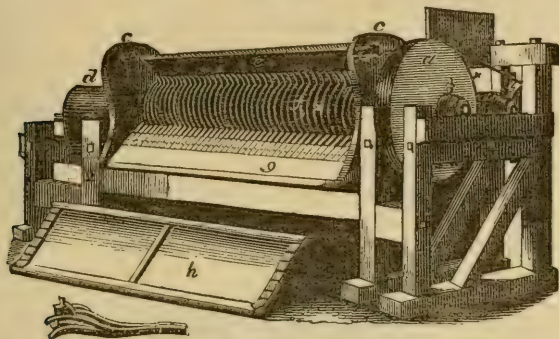
sheets are placed at convenient points, into which the bags are emptied when full. The general average for each hand ranges from forty-five to fifty pounds per day. The freshly-picked cotton is dried upon scaffolds, each of which is not over four feet in width, to allow it to be turned with facility while drying. If rain threatens, the scaffolds are conveyed to the cotton-house, near which they are always placed. After being perfectly dried, the cotton is prepared for market by separating the wool from the seed.

Whipping the Cotton.—The first machine through which cotton is passed is called a “whipper,” and consists of a cylinder six or eight feet in length, made of slats, reeds, or wire. One end is closed, and the other open. The centre of the cylinder is traversed by a shaft, intersected with rods reaching to within an inch of the sides. The cylinder is placed in an inclined position, and the cotton fed into it from a hopper resting upon the upper side, near the top, which is closed. The shaft being turned by a crank, the cotton, as it falls from the hopper, is whirled round by the rods until it issues from the lower end of the cylinder—any contained dirt, sand, or leaves having meanwhile escaped through the open sides of the “whipper.” The cotton is then carried to the gins.

Ginning.—Two kinds of gin are employed—one, called the “saw gin,” being used for all the short-stapled cottons, while the other, known as the “roller gin,” is confined to the Sea Island, or long-staple. The latter we shall first describe. This is a very simple machine, consisting of two wooden rollers, about a half inch, or one inch in diameter, revolving upon each other in opposite directions, and mounted upon a wooden frame, to which is appended a fly-wheel, from two to three feet in diameter. Motive-power is supplied by a treadle and crank, which is operated by a man who stands in front of the rollers, and feeds the cotton to them in small quantities. The perfect separation of the seed from the cotton depends mainly upon the small diameter of the rollers, and the slowness of their revolution. From twenty-five to thirty pounds can be cleaned each day by one gin; previous to passing through which it is sorted by women, who carefully remove from it all the yellow cotton, as well as all the motes, &c., which may have passed through the “whippers” with it. Each female examines and cleans from sixty to one hundred pounds per day. After passing through the gin, and parting with its seed, the cotton is again turned over to women, and subjected to a second examination, when all remaining impurities are removed from it. As this work must be well done, but thirty pounds per day are required from each woman. Short-stapled cottons are cleared from the adhering seeds by

the "saw-gin," which is thus constructed: A wooden box contains within it a roller, or shaft, of the same material, which, at every inch of its

Fig. 64.



length, carries a circular saw, about twelve inches in diameter, with hooked teeth. Above, or in front of these saws, is placed a box, the part of which next the saws is composed of metal slats, between which the saws pass to the distance of an inch. This box being filled with cotton, the revolution of the saws carries the cotton gradually around, until the whole has been drawn through the slats, leaving the seeds behind. These are then discharged, and the box refilled with uncleaned cotton. Considerable waste attends this mode of separating the seed from the wool, besides the injury done to its quality by the breakage of the fibres in passing through the slats.

Packing.—The bags in which cotton is packed will usually hold about 400 or 450 pounds; and various methods have heretofore been used for filling and compressing these bags or bales, all of which have been more or less complicated and costly. An invention of Levi Dederick, New York, has supplied the machine long needed—one combining great power with simplicity and cheapness. It is portable, and can be moved from place to place at pleasure; is operated by a horse and capstan; and, with two men and a boy, will pack from twelve to sixteen bales of cotton per day.

Uses.—Besides the cotton furnished by the plant, which is woven into various fabrics, the seeds are also valuable for many purposes. They are excellent food for cattle, furnish a very superior oil for table purposes, and make the best manure which can be used on a plantation.

TOBACCO PLANT.

Description.—This plant (known to botanists as *Nicotiana*,) was originally derived from the Island of Tobago, in the West Indies, whence its present appellation. It is a very powerful narcotic, as well as a strong stimulant to the nervous system, and, when taken into the stomach in small doses, acts both as an emetic and a purgative. The smoke of tobacco, as also the decoction and powder, are used to destroy insects which infest the growing plants in gardens and fields. The tobacco plant has a branching, fibrous root, from which springs a stem, varying in height from three to six feet, round, hairy, and branching at the top.

Fig. 65.



The leaves are very large, of a pale green color, and covered with short, glandular hairs; those nearest the ground being the largest, but furnishing the coarsest tobacco. The flowers grow in panicles on the ends of the stem and branches; and the seeds, which are small, but very numerous, have a somewhat reniform shape, and brown color. While growing, the tobacco plants require constant attention to free them from weeds, and from the lower leaves, which, being coarse and strong, interfere with the full development of the finer leaves at the top.

Varieties.—Botanists class many different species under the genus *Nicotiana*, viz: Virginian (*N. tabacum*), large-leaved (*N. macrophylla*), shrubby (*N. fruticosa*), sweet-scented (*N. undulata*), common green (*N. rustica*), paniced (*N. paniculata*), clammy (*N. glutinosa*), curled-leaved

(*N. plumbaginifolia*), primrose-leaved (*N. pusilla*), four-valved (*N. quadrivalvis*), dwarf (*N. nana*), Langsdorff's (*N. Langsdorffii*), honey-wort (*N. cerinthoides*), and Havana (*N. repanda*). The Virginia tobacco is the variety most generally grown in the United States, and the Havana (*N. repanda*,) is that from which the finest and most fragrant cigars are made. Tobacco is cultivated to some extent in Europe, as far north as Sweden, and it is also grown in Asia, Africa, and South America. The common green variety being more hardy than the Virginia, is cultivated in Germany, and other northern countries, where the majority of the families who have gardens raise a sufficiency for their own use; but, not being properly cured, it is only used for smoking, and possesses but little value.

Raising the Plants.—The first process in tobacco culture is to make provision for an abundant supply of plants; as, owing to the small size of the seed, and the tardy growth of the plants, the young shoots would soon be smothered by weeds if not carefully protected. New ground, or land which has been a long time in grass, should be selected for the location of plant-beds, because less likely to produce weeds; to guard more effectually against which, and to insure a growth of thrifty plants, the land should be burned over with brush, or cord-wood, which may be moved from place to place with long iron hooks. Before burning new ground, all the old roots should be grubbed up, the rubbish cleared away, and the dead leaves raked off; and it would be advantageous to skim off sod-ground with sharp hoes, before it is burned over. When the ground has cooled off, and the ashes have been carefully removed, the soil should be broken up with hoes, finely pulverized, and well raked. The land having been laid off in beds, about four feet wide, and somewhat elevated, the seed should be sown upon it in the proportion of a table-spoonful to fifty square yards, well raked in with an iron rake, and the beds trodden down to render them firm and compact. A thin covering of brush must then be placed over the beds to keep them moist, and to protect the plants from the frost. The beds should be prepared and sown as soon as the frost is out of the ground. When the plants have attained a good size, and there is no longer any reason to dread frost, the covering of brush may be removed, and the beds weeded by hand; care being used to avoid bruising the tender plants.

Soil and Climate.—Tobacco flourishes best in rich, light, alluvial, loamy soils, or such as have been recently cleared. Lands which have been long in grass, especially sheep pastures, produce excellent tobacco. As it is an exhausting crop, it should not be planted too often on the same land, but give place to grain and grass, which latter should be allowed to remain on the ground for two or three years. This plant

arrives at full perfection only in a warm climate, and can never be grown to advantage in elevated situations, in northern exposures, or on wet and springy land. Although, being an annual plant, it may mature even in Russia and Sweden, yet the plants will be puny and devoid of flavor. In moist and not very warm climates, like that of Ireland, the plants may attain a very large size, but will be wanting in that superior flavor which can be imparted only by sunshine, and pure, dry air. The Southern States are well adapted to its culture, and produce chewing-tobacco of a peculiarly rich flavor, though the fragrant tobacco of Cuba surpasses it for smoking purposes.

Mode of Culture.—In preparing the ground, care must be used to plough it deeply, and to completely pulverize the soil. Grass lands intended for tobacco should always be ploughed the previous autumn; and all kinds of land intended for that purpose would be benefited by being turned over before frosts set in. In the spring the land should be manured, cross-ploughed, and well harrowed just before planting, which is usually done during the months of May and June. The ground must be laid off into ridges, by a single-horse plough, with three and a half or four feet between the centres, according to the kind of tobacco which is to be planted, and crossed at the same distances by a shovel-plough, or one with a double mould-board. Every square thus made must be scraped with the hoe into the form of a hill, in which one plant must be set. Plants can only be set after a rain, and much care must be taken in performing the operation; for if plants are well set they will grow quickly, but bad setting will retard them. In case they die from drought, or are destroyed by worms, others must be planted in their places. The after-treatment is very similar to that applied to Indian corn—the plough, cultivator, and hoe being used alternately to keep down the weeds, and mellow the earth. During the last ploughing, the middle of the day should be chosen for the purpose, when the leaves, having wilted, will not easily break.

Topping and Priming.—As the plant develops, a blossom bud grows out from the top, which is called “buttoning.” This top being pulled off, with those upper leaves that are too small to be of value, the plants are thus reduced to a height of two or three feet. The first topping will always admit of a greater number of leaves being left, and, in proportion as the season advances, the number should be reduced. The heavier kinds of tobacco are usually topped early in the season to twelve leaves, then to ten, and still later to eight. Light tobacco, for segar wrappers, may be allowed to mature sixteen or eighteen leaves. Priming consists in breaking off the leaves next the ground, which, to the number of four

or five, have no value. A good rule is to prime six inches, and top to eight leaves; but if the land is poorer than common, or if, from the backwardness of the plant, and the advanced state of the season, frost is apprehended, the priming should not be carried higher than four inches. If the soil is unusually rich, and there is danger that the top will come to the ground, then the priming must rise in proportion.

Suckering and Worming.—Every plant requires to be twice suckered before it is ready for cutting. These shoot out from every leaf, and must be broken off in such a way as not to injure the leaf. They are of quick growth, and require early removal, else they will not only injure the growth of the plant, but will endanger the destruction of leaves in removing them. Tobacco is very subject to injury by the horn- and cut-worms, which should be frequently sought for and destroyed.

Cutting and Housing.—The cutting season commonly commences in August, and continues into September. When tobacco is ripe, the leaves assume a spotted, yellowish appearance, and are so thick and rigid that they may be cracked or broken by folding and pressing them gently between the thumb and forefinger. Tobacco must be split while standing; and such hands as can readily distinguish between the ripe and green plants should be employed at this labor. Armed with a broad flat cutter, somewhat like a square meat-chopper, a skilful operator splits the plants, with great rapidity, to within six inches of the ground. The cutter follows after, and, with a common hemp-hook cuts the plant up, and lays it on the ground, where it is exposed to the rays of the sun for a few hours, until the leaves fall and wilt. As there is danger of the plants being burned by the too-powerful heat of the sun at mid-day, the cutting should be done in the mornings and evenings; only such quantity being cut at once as may be easily secured before the sun has acquired sufficient power to injure it. When the plants have wilted sufficiently, they should be piled with their butts toward the sun, as the stems, being large and rigid, require more sun to make them fall. Much care must be used in handling the plants, to avoid bruising the leaves; and the plants first cut should always be placed at the bottom of the heap, so that, as near as possible, all may be exposed to the sun's rays an equal length of time. If the tobacco-house is near to the field, sleds are very convenient vehicles for transporting the tobacco; but if at a distance, a wagon will be preferable, coupled so as to hold a very long body, sufficiently high to hang the tobacco on sticks across it. The sticks being filled with plants in the field, and then placed on the wagon in a row, nothing but the butts of the plants are presented to the action of the sun while being transported to the drying-house. No more tobacco

should be cut at one time than can be hung up in the drying-house, as great loss is attendant upon leaving it in heaps. The sticks on which the tobacco is hung should be placed in tiers above each other, and a distance of from eight to twelve inches left between them, according to the size of the tobacco—thus admitting a free circulation of air. When partially cured, the spaces may be diminished, to make room for another cutting. If the tobacco is to be cured without fire, the house cannot be too open on the sides; but if fire is used, the sides of the building must be perfectly tight, and no openings left for the escape of smoke, except in the roof.

Curing.—This is a nice operation, and requires skill and attention, as upon its proper execution depends the quality and value of the tobacco. For the first forty-eight hours the fires should be moderate; the mercury ranging from 100° to 115° . When the edges of the leaves begin to turn yellow, and the tips to curl, the fires should be raised, but not allowed to get too hot, for then the aromatic oil passes off with the sap and smoke, leaving an inferior red-colored tobacco. And again, if the fires are too low, the tobacco sweats, and the oil escapes. The latter danger, however, is not so imminent as the former; more tobacco being injured by too much heat, than by a lack of it. The fires having been gradually raised until the mercury indicates 160° , they must be kept at that point until the tobacco is cured. In making kite-foot tobacco, the rule is to cure the plant, stems and all, in forty-eight hours from the time the fires are raised, which is when the leaves begin to assume a yellow color. After thus commencing to change, the entire leaf very soon takes on the same appearance, when it becomes an object to cure it before it turns to a nutmeg-brown. If not very speedily cured, the whole, or a great part of it, will change to the latter color before the operation is completed.

Stripping and Prising.—When the plants are sufficiently dried, which may be judged of by the stems becoming hard, the leaves may be stripped from the stalks. A damp spell during the winter or spring is the best time for this operation, as the moisture in the air prevents the leaves from crumbling. They must then be sorted into three classes: 1st, comprising the best quality and color; 2d, that which is inferior; 3d, the ground leaves. The leaves may then be neatly tied up in bundles called “hands,” each containing either four leaves of the first class, or six of the second and third classes. The “hands” must then be “put down to condition,” as it is usually termed; that is, packed in large bulks, with the tails in the middle, and the heads on the outside, and subjected to heavy pressure by weights. In this state it undergoes a sweat; but as soon as it commences to heat it must be taken out, and hung up to dry,

and there left until a rain shall again bring it into *case*. It should then be put down in very large bulk; the number of courses being six, eight, or any higher number, and the whole enclosed by soft straw, the walls of the house, and plank, so as to exclude the air entirely. In this condition it may be kept for any length of time, and will always be ready for hauling to market in the "hand" or "prising." When the cover of the bulk is removed, with the view of taking out a part of the tobacco for prising or sale, the entire top course, or courses, should be smoothly separated from the rest, and the cover carefully replaced. This is necessary to prevent the top of the bulk from becoming too dry. Prising should be done in weather when the condition of the tobacco will not change. Each bundle should be straight, and closely packed in hogsheds in the usual way. When prising in summer, some elder-bushes may be spread over the bulk to keep the tobacco damp.

Nicotine.—When the dried leaves of the tobacco-plant are moistened with water, tied together in small bundles, and placed in heaps, fermentation soon commences, and is accompanied by the absorption of oxygen; the leaves then become quite warm, and emit the smell usually perceived in prepared tobacco and snuff. If the fermentation is carefully promoted, and too high a heat avoided, this smell increases, and becomes more delicate; and, on the completion of the fermentation, an oily, azotized, volatile matter, called *nicotine*, is found in the leaves, which, though possessing all the properties of a base, was not present before the fermentation. Nicotine is a very powerful and deadly poison.

RICE.

Varieties and Description.—There are four principal varieties of rice, viz: the common rice (*Oryza sativa*), the dry or mountain rice (*O. mutica*), early rice (*O. præcox*), and the clammy rice (*O. glutinosa*); though the inferior varieties are as numerous as the different soils, climates, and other physical circumstances controlling its culture. The culm of the common rice is from one to six feet in height, annual, erect, simple, round, and jointed. The flowers are disposed in a large and beautiful panicle, simulating that of the oat; the leaves slender, awl-shaped, curved, and embracing; the leaflets lance-shaped, and resembling a calyx; the valves of corolla of equal length—the inner even and awnless; the outer twice as wide, four-grooved, rough, and awned; the style single and two-parted. Rice can be profitably cultivated only in warm climates, although it has been in a measure acclimated to districts of Germany, and small parcels have been raised in the neighborhood of Annapolis, in Maryland.

A crop has been obtained even as far north as England, on the banks of the river Thames. These cases are mere exceptions, however, to the

Fig. 66.



natural habits of the plant, and furnish no ground for an opinion as to the possibility of cultivating it with profit in high latitudes. It is raised in immense quantities in India, where the lands can be flooded, and also in Japan, Cambodia, Cochin China, and the southern provinces of China. In South Carolina it has long been a staple, having been introduced there during the sixteenth century.

Mode of cultivation in South Carolina. — The planting is commenced about the 25th of March; the ground is trenched shallow but wide, and the seed scattered in the rows, in the proportion of two bushels to the acre. It is hoed about the close of April, or the beginning of May, when the rice is in the fourth leaf, and the field then covered with water. If the planting be late, and there is danger of grass, the field is flooded before hoeing. The usual depth of water is about three or four inches, just sufficient to allow the tops of the rice to appear above it. When the water is of proper depth, a notch is made on the frame of the feed-trunk, and if the rains raise the water above the notch, or it leaks out, it must be let off or added to accordingly. This is done by putting a small stick, about an inch in diameter, in the door of the trunk. If scum or froth appear in eight or ten days, the water is changed, by taking off the trunk door, allowing it to run off with the ebb tide, and refilling at the next flood. The water is kept on about fifteen or seventeen days, according to the state of the weather: if the sun is hot, fifteen days; if the weather is cool, and the atmosphere cloudy, seventeen days, counting from the day the field is flooded. The water is allowed to leak off for two days, when

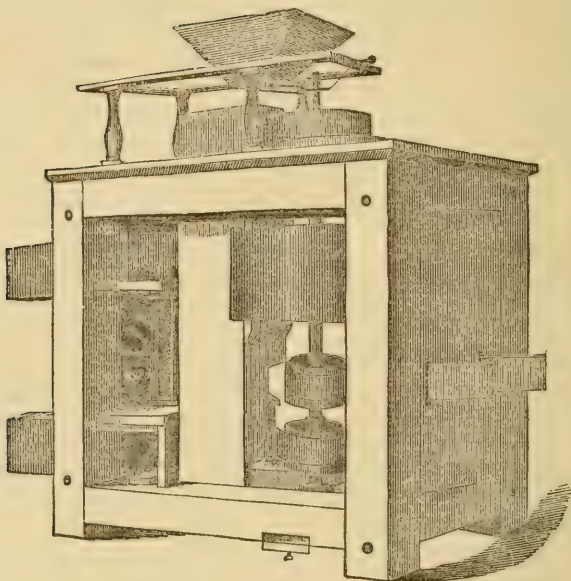
the whole is run off, and the field allowed to dry. In four or five days it is hoed a second time, the ground stirred up, whether clean or not, and the fallen rice combed up with the fingers. About the beginning of July it is hoed the third time, and picked clean. The field is then flooded as it is hoed, the water being regulated to the same depth as before. If any grass escapes, it is picked out in the water after it shoots up. Though this is called the fourth hoeing, the hoe is never used, except in some high places, or in cleaning the dams. If the rice is flaggy, and likely to lodge, it is supported by flooding it deeply, and so kept until it is fit for harvest. With well-drained land, in good order, each hand may readily cultivate five acres of rice, and one or one and a half of provisions.

Chinese mode of cultivation.—The Chinese obtain two crops per year from the same land, and cultivate it in this way from generation to generation, on the same soil, and without other manure than the mud deposited by the water of the river used in flooding it. A few days are allowed for the mud to get partially dry, after the water has been drained off, when a small spot is enclosed by a bank of clay, slightly ploughed and harrowed, and the grain, previously steeped in dung, diluted with animal water, is sown very thickly on it. A thin sheet of water is then brought over it, either by a led stream, or by the use of the chain-pump. A seed-bed, or nursery, is thus prepared, and, in the meantime, the rest of the tract is being put in order for planting. When the plants are six or seven inches high, they are set out in furrows made by the plough, and so planted as to stand a foot apart every way. Water is then brought over them, and so kept till the crop begins to ripen, when it is withdrawn, and the field dried for the harvest. The rice is reaped with a sickle, threshed with a flail, or trodden out by cattle, and the husk taken off by pounding it in a stone mortar, or by passing it between two flat stones, as in a common mill. The first crop is cut in May, and the second, immediately prepared for by burning the stubble, ripens in October or November. When this is cut, the stubble is ploughed in, which is the only vegetable manure such lands receive. Aquatic rice is cultivated in the same manner in Java, Ceylon, and Japan.

Cleaning Rice.—This operation is now usually effected by the aid of the machine figured on the next page, which divests it of the husk, and polishes the grain at the same time.

Uses.—Rice has been extolled, and very justly, as superior to any other article of vegetable diet; yet in Europe, and in many parts of the United States, the preference is generally assigned to the potatoe, which contains far less nutriment. In Hindostan, the natives, fed on rice and curry, perform tasks in the burning sun which any white laborer, whose diet

Fig. 67.



included roast beef, potatoes, and porter, never could accomplish. Rice may be used in the whole grain, or in flour, in an indescribable number of ways.

THE TEA PLANT

As it is more than probable that, ere long, this important shrub will be successfully cultivated in many portions of the United States, a description of the mode of cultivation and process of manufacture may, with great propriety, be introduced among the general details of American farming. Tea was grown in Georgia as far back as 1772, but, for some unexplained reason, its culture was abandoned. In 1848 the late Dr. Junius Smith, of Greenville, South Carolina, imported a large number of the plants, which, after cultivation in his garden until March of 1851, he set out on his plantation, where they grew remarkably well. In January of the latter year, they suffered no injury from a snow eight or nine inches deep, which was accompanied by intensely cold weather. Efforts are now being made to introduce the tea plant generally through-

out those States whose climate is suited to its cultivation; and, with proper management, the ultimate success of these endeavors is beyond the possibility of a doubt.

Varieties and Description. — There are but two known varieties of the tea plant—*Thea viridis*, or green tea; and *Thea bohea* (Fig. 68), or black

Fig. 68.



tea. The first-named is a large, strong-growing, almost hardy plant, with spreading branches, leaves three to five inches long, very broadly lanceolate, pale green, singularly waved, and the margin reflected. The flowers, which are large, solitary, and mostly confined to the upper axil, appear in autumn, six weeks or two months earlier than those of *T. bohea*. The latter plant is of smaller size, with remarkably erect, stiff branches; the leaves are not above one-half or two-thirds the size of those of the *T. viridis*, perfectly flat, more coriaceous, and dark green. On the axils of numerous leaves two or three flowers are borne, which are small, have a slight fragrance, and are in perfection during winter.

Soil and Climate. — The tea-plant delights to grow in valleys, at the foot of hills, and upon the banks of streams, where it has the benefit of a southern exposure. The soil best adapted to it is a rich, porous loam, containing a considerable admixture of vegetable mould; and the land must be thoroughly drained — the shrub refusing to grow in low, wet lands. Those districts in the United States which are best suited to the growth of the plant, are the alluvial tracts bordering on the tidal streams of Virginia, North and South Carolina, Georgia, Alabama, and Florida, and the undulating portions of Texas, Louisiana, Mississippi, Kentucky, and Tennessee.

Culture. — The seeds are gathered in October, packed in sand for pre-

servation during the winter, and in spring sown in rows, distant about four feet from each other. From three to five seeds are dropped in each place, at intervals of three feet along the rows. With the exception of stirring the earth, and eradicating the weeds, the plants remain undisturbed during the first two or three years, until they are well established, and putting forth strong and vigorous shoots. On properly-managed tea plantations, a regular succession is always kept up, so that the failure of old plants is compensated by the constant maturing of an equal number. Plucking the leaves being very prejudicial to the health of the shrub, the operation is never commenced until it is in a vigorous condition. When the plants are in their third year, the first crop is usually gathered; and they continue to yield until they are ten or twelve years old. The best time for gathering tea is while the leaves are small, young, and juicy; and the first gathering usually commences about the close of February, when the leaves are young and unexpanded; the second about the beginning of April; and the third during the month of June. The first collection, which only comprises the tender leaves, is the most esteemed, and is known by the name of imperial tea; but, as the season advances, the quality and value diminish, until the lowest grade is reached, called bohea. While under cultivation, the tea-plant rarely attains a greater height than three or four feet.

Manipulation of the Leaves.—1. *Green Tea (Thea Viridis).* Leaves intended for green tea are thinly spread out on trays, where they remain for one or two hours, in order that the superfluous moisture may be evaporated, when they are thrown into the roasting-pans, placed over brisk wood fires. In these pans they are rapidly moved about and shaken up by the workmen until they become quite flaccid and moist, and give off considerable vapor. After remaining in the pans four or five minutes, they are transferred to the rolling-table, and divided among several workmen, each of whom takes up as many as he can press together with his hands, works them up into the form of a ball, and rolls them upon the table until they are greatly compressed. Much of the moisture is removed by this process, and the leaves obtain the desired twist. They are then shaken out upon flat trays, and, after remaining thus for a short time, are again thrown into a pan, placed over a slow but steady charcoal fire, where they are kept in rapid motion by the hands of the operators. In about an hour the leaves are well dried, and exhibit a dull green color, which subsequently becomes brighter. When a sufficient quantity of leaves have been thus treated, they are winnowed through sieves of different sizes, by which several varieties of tea are made, according to size, and the whole cleansed from dust and other impurities.

During this operation the coarse teas are once reheated, and the finer qualities three or four times, by which the leaves acquire a dull bluish-green color. — 2. *Black Tea* (*Thea Bohea*). The leaves which are to be manufactured into black tea are first heated and manipulated as above described; after which they are transferred to a tubular-shaped basket, somewhat resembling a dice-box, and containing a sieve. This apparatus is placed over a charcoal fire, where it remains but a few minutes, when the leaves are taken out, and again rolled; this operation being repeated a second, and sometimes a third time. When all the leaves have been thus treated, they are replaced in the baskets in bulk, and set over a slow fire, and, being covered over with a flat basket, are allowed to remain thus until quite dry; being carefully watched, however, and occasionally stirred, so as to expose them equally to the heat. A black color is thus produced, which subsequently improves. The other processes of sorting, sifting, and reheating, being similar to those used with the green teas, need not here be again detailed.

BROOM CORN.

Varieties. — According to Allen, a distinguished writer on agricultural subjects, there are four or five species of the broom grass. There are several varieties, of which the pine-tree kind is regarded the poorest, or the least advantageous for cultivation; yet, as it is the earliest, — being three weeks earlier than the large kind, — in a short season, when its seed will ripen, while the seeds of the other kind fail to ripen, this may prove the most profitable crop. The North river crop is ordinarily the best crop, being ten days earlier than the large kind, and yields about seven hundred pounds of brush to the acre — the brush meaning the dried panicles, cleaned of the seed, with eight or twelve inches of the stalk. The New Jersey, or large kind, yields about one thousand pounds of brush per acre. The stalks and seed are large. In good seasons this is the most profitable crop. Alluvial lands are best adapted for the broom corn, more especially if warmly situated, protected by hills, and well manured.

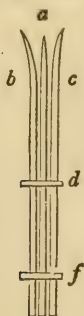
Method of Planting. — The broom corn is planted in rows, about two and a half or three feet apart, so that a horse may pass between them with a plough, or cultivator, or harrow. The hills in each row are from eighteen inches to two feet apart, or further, according to the quality of the soil. The quantity of seed to be planted is estimated very differently by different farmers. Some say that half a peck is enough for an acre, while some others plant half a bushel, and some a bushel, in order to make it sure that the land shall be well stocked. The rule with some is to cast a teaspoonful, or thirty or forty seeds, in a hill. The manure at the time of planting should be put

into the hill, and old manure or compost is preferred, as being most free from worms.

Culture. — The broom corn should be ploughed and hoed three times, — the last time when about three feet high, though some hoe it when it is six feet high, and when they are concealed by it as they are toiling in the field. The number of stalks in a hill should be from seven to ten; if there are only five or six stalks, they will be larger and coarser, and if there are about eight, the brush will be finer and more valuable. In the first hoeing, the superfluous stalks should be pulled up

Harvesting. — As the frost kills the seed, the broom corn is harvested at the commencement of the first frost. The long stalks are bent down at two or two and a half feet from the ground, and by laying those of two rows across each other obliquely, a kind of table is made by every two rows, with a passage between each table for the convenience of harvesting. After drying for a few days, the brush is cut, leaving of the stalks from six to twelve inches. The longer it is cut, of course, the more it will weigh; and, if the purchaser does not object, the benefit will accrue to the farmer. However, the dry stalk weighs but little; if its weight is excessive, the purchaser sometimes requires a deduction from the weight. As it is cut, it is spread on the tables, still further to dry. As it is carried into the barn, some bind it in sheaves, which is a great convenience for the further operation of extracting the seed. Others throw the brush into the cart or wagon, unbound.

Fig. 69.



Scraping. — The process of extracting the seed is called “scraping the brush.” Two iron horizontal scrapers are prepared, — one movable, to be elevated a little, so that a handful of brush may be introduced between them. The upper scraper is then pressed down with one hand, and the brush drawn through with the other, the seed being scraped off. This is

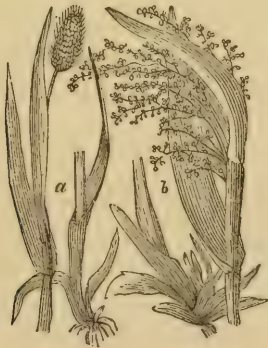
the old method. A newly-invented scraper is superseding the old one. It is an upright instrument, of elastic wood or steel, inserted in a bench of convenient height for the operator. The form (Fig. 69) is as follows: *a* is a piece of wood or steel, immovable; *b* and *c* are pieces which are elastic, movable to the right and left at the top, but fastened to the central piece below. The degree of elasticity may be regulated by wedges in the planks *d* and *f*—wedges in the hole through which the pieces pass. A quantity of brush is taken in the hand, and brought down upon the top of this instrument. As it is forced down and drawn towards the body, it separates the elastic sticks from the central piece, but their elasticity presses sufficiently on the brush, so that the seed is scraped off. The advantage of this scraper is, that both hands may be applied to the brush, instead of only one hand, as in the other kind, and the elastic power of nature is substituted for the pressure of one of the hands. The instrument also seems to double the scraping surface.

Uses. — For the manufacture of brooms it is unsurpassed. The seed is also used for feeding horses, cattle, and swine. It is ground and mixed with Indian meal, and is excellent food. It weighs forty pounds a bushel.

MILLET.

Varieties. — There are two kinds of Millet cultivated: the German Millet (*a*) and the Cultivated Millet (*b*). The cultivation required by both is about the same.

Fig. 70.



Soil. — Millet requires a warm, rich, sandy, well-pulverized soil. It succeeds better when sown after some crop which has been abundantly

manured than it does when sown immediately after an amelioration of undecomposed manure. The soil must be tilled to a considerable depth for its reception, and ploughed three times, besides harrowing, rolling, and weeding. It is generally very successful on newly-drained land, provided it is in good condition, and also land which has been left in repose for several years; in the latter case, a single ploughing is sufficient, if the soil is afterwards harrowed, and well broken-up with a roller, before the seed is put into it.

Sowing.—Millet should be sown in May; a harrow is then passed lightly over the soil, and, where the ground is dry, a roller must also be used. The seed must be wholly ripe, perfect, and free from disease.

Culture.—As soon as weeds make their appearance among millet which is just shooting above ground, they must be eradicated; thorough weeding is an indispensable operation in the culture of millet.

Great attention is also requisite to seize on the exact time when the plant attains maturity, especially with common millet, which ripens very unequally, and is very liable to shed its seed. Those who only cultivate millet in patches cut off the spikes as they ripen, and carry them home in sacks; but as this can only be done where this plant is cultivated but little, the reaping must be commenced as soon as the greater part of the plants are ripe, and performed in a careful manner with a sickle. The plant must not be left on the ground in swaths, because, if rain comes on, and it gets wetted, it sheds its grain. It should, on the contrary, be immediately carried to the barns, and there threshed, and freed from all impurities and foreign substances. The grain should then be spread, in very thin layers, over the floor, and stirred about every day with a rake, until perfectly dry; otherwise, it will become heated and bitter. The straw is tied up, even though moist, and carried into the air to be dried; if not properly dried, it will become mouldy on being stacked. This straw is much esteemed as provender for cattle.

Although, when cultivated to any great extent, it is not possible to cut off the ears separately as they ripen, it is well to gather all those in this manner which are to be used for seed. Grain which ripens thoroughly, and of which proper care has been taken, shoots up evenly, and produces perfect plants, free from disease, and especially from smut, which frequently manifests itself in this grain where proper precautions have not been taken. That portion of millet which is intended for seed should also be preserved in a dry and airy place, and should be threshed when wanted.

HEMP.

Fig. 71.



Soils. — The soils which produce this article best are those which are fresh, or which have lain some time in grass or clover. Manuring is not much practised, clover being used in place of it. Deep, black, putrid vegetable lands, which have a low situation, and somewhat inclined to moisture, as well as the deep, mellow, loamy or sandy sorts, are well adapted. Mellow, rich, clayey loams do well, and so does old meadow-land.

The preparation of the ground, for sowing the seed, is by the plough and horses, until the clods are sufficiently pulverized or dissolved, and the surface of the field is rendered even and smooth. Scarcely any other crop better rewards diligence and careful husbandry. Fall and winter ploughing is practised with advantage — it is indispensable in old meadows, or old pasture-grounds.

Culture. — Plants for seed are ordinarily reared in a place distinct from that in which they are cultivated for the lint. The seeds intended to reproduce seeds for the crop of the next year are sowed in drills about four feet apart. When they are grown sufficiently to distinguish between the male and female stalks, the former are pulled and thrown away, and the latter are thinned, leaving the stalks separated seven or eight inches from each other. The male plant alone blossoms, and, when agitated, throws off farina, a yellow dust or flour which colors the ground, or any object with which it comes in contact. A few of the male plants had better be left, scattered through the drill, until the farina is wholly discharged, for as

obvious reason. Between the drills a plough is run sufficiently often to keep the ground free from weeds and grass, and between the stalks in each drill the hoe is employed for the same object. The seed plants are generally cut after the first smart frost, between the middle or last of September and the middle of October, and carried to a barn or stackyard, where the seeds are easily detached by the common thrail. After the seeds are threshed out, spread them on a floor, to cure properly and prevent their rotting, before they are finally put away for use the next spring. The seeds — whether to reproduce seeds only, or the lint — are sowed about the same time, which time depends on the season, though it is generally agreed that all the month of May, and about the 10th of it especially, is the most favorable time.

When the object is to make a crop of hemp, the seeds are sown broadcast. The usual quantity is a bushel and a half to the acre, though some use more. When the seeds are sown, they are ploughed or harrowed in; ploughing is best in old ground, as it avoids the injurious effect of a beating rain, and the consequent baking of the earth. It is also beneficial afterwards to roll the ground with a heavy roller.

Gathering. — After the seeds are sown, the labors of the cultivator are suspended until the plants are ripe, and in a state to be gathered — everything, in the intermediate time, being left to nature. If the season be favorable until the plants are sufficiently high to shade the ground, (which they will do in a few weeks, at six or eight inches height,) there is a strong probability of a good crop. When they attain that height, but few articles sustain the effect of bad seasons better than hemp.

It is generally ripe and ready to be gathered about the middle of August, varying according to the time of sowing. Some sow at different periods, in order that the crop may not all ripen at the same time, and that a press of labor, in reaping it, may be thus avoided. The maturity of the plant is determined by the evaporation of the farina, already noticed, and the leaves of the plant exhibiting a yellowish hue; it is then generally supposed to be ripe, but it is safest to wait a few days longer.

Two modes of gathering the plants are practised, — pulling and cutting; the latter is now generally preferred. When pulled, it is done with the hand, which is better for the protection of an old leather glove. The laborer catches twenty or thirty plants together, with both hands, and, by a sudden jerk, draws them without much difficulty. The operation of cutting is performed with a knife, often made out of an old scythe, resembling a sickle, — not so long, but broader. This knife is applied much in the same way as the sickle, except that the laborer stoops more. But, whether pulled or cut, the plants are carefully laid on the ground, the evenness the

better, to cure, which they do in two or three days, in dry weather. When cured the plants are set up in the field in which they were produced, in shocks of convenient size, the roots or butt-ends resting on the ground, and the tops united above by a band made of the plant itself. Previously to putting them up in shocks, most cultivators tie the plants in small hand bundles. Before the shocks are formed, the leaves should be rapidly knocked off, with a rough paddle or hooked stick. The shocks are collected together and formed into stacks, which are sometimes permitted to remain over a year.

Rotting. — Two methods of rotting are practised — the dew-rotting and the water-rotting. When dew-rotted, the plants are usually spread down from the middle of October to the middle of December. A farmer who has a large crop on hand puts them down at different times, for his convenience in handling and dressing them. Autumnal rotting is more apt to give the lint a dark and unsightly color than winter rotting. The best ground upon which to expose the plants is meadow or grass land. The length of time they ought to remain exposed depends upon the degree of moisture and the temperature of the weather that prevail. In a very wet and warm spell, five or six weeks may be long enough. To determine whether they have been sufficiently rotted, a handful is taken and broken by the hand or applied to the brake, when it can be easily ascertained, by the facility with which the lint can be detached from the stalk, if it be properly rotted. If the fibres remain on the ground too long, they lose some of their strength, though a few days longer than necessary, in cold weather, will do no injury. If they are taken up too soon, that is, before the lint can be easily separated from the woody part of the stalk, it is harsh, and the process of breaking is difficult. Snow-rotting, that is, when the plants, being spread out, remain long enough to rot, (which, however, requires a greater length of time,) bleaches the lint, improves the quality, and makes it nearly as valuable as when water-rotted.

Breaking and Dressing. — After the operation of rotting is performed, the plants are again collected together, put in shocks or stacks, or under some covering. Breaking and dressing are best performed in February and March; and the best sort of weather, frosty nights, and clear, thawing days. The brake cannot be used advantageously in wet or moist weather.

The usual daily task of an able-bodied hand at the brake is eighty pounds weight, though this depends on the weather and the condition of the stalks. The quantity of net hemp produced to the acre is from six hundred to one thousand pounds, varying according to the soil and the season. It is said that the quantity which any field will produce may be anticipated by the average height of the plants throughout the field. Thus, if the plants will

average eight feet in height, the acre will yield eight hundred weight of hemp, each foot in height corresponding to a hundred weight of the lint.

Hemp exhausts the soil slowly, if at all ; and nothing cleanses and prepares the earth better for other crops than hemp, especially for small grain or grasses. It eradicates all weeds, and, when it is taken off, leaves the field not only clean, but smooth and even.

FLAX.

Varieties. — The most important species of this plant — the only one forming the subject of cultivation — is the common flax, which has been applied to the making of cloth from time immemorial.

Fig. 72.



Soils. — The soils best suited to the growth of flax are those which contain a large proportion of vegetable matter in their composition. Strong clays do not answer well, nor soils of a gravelly or dry, sandy nature. If the soil be too much enriched by the application of manures, the flax will grow too luxuriously, and produce a coarse fibre ; and if it be deficient in fertility, the produce will be scanty and unremunerative. Soils of the alluvial formation are peculiarly adapted ; also land having a black, mossy surface, or what is called gray land, and where the lower part of the soil is clay, resting on a retentive subsoil. Crops of flax of considerable value have often been reaped from land on which the produce of oats was inferior.

In the preparation of the soil for flax, it is of importance that it should be reduced to a fine tilth, and be free from weeds. When the previous crop has been grass, a single ploughing only is given, which is to take place early in winter ; when the period of sowing arrives, the land is to be well har-

rowed, to prepare it for seed. When flax succeeds a corn crop, the land is also ploughed early. Two ploughings are generally required in the spring.

Culture. — In the culture of flax, the broadcast system is universally adopted, and, after sowing, a double turn of the harrows is given to cover the seeds. In most cases it is advantageous that the whole should be rolled, and, in damp situations, water-furrowed. When it succeeds any of the green crops, the grass-seeds and clover-seeds are sown at the same time as the crop. In this case the preparation of the land is easy.

The period of sowing is in the month of April or May. The quantity of seed sown will depend, in some measure, on the object in view in cultivating the plant. When the quality of the fibre is regarded rather than the quantity, thick sowing is advisable; but if it be intended to save the seed of the crop for the purpose of reproduction, it should be sown thin, in order that the plants may have room to throw out their shoots, and to have free access of air in the blossoming and filling seasons. Three bushels of seed may be regarded as the proper quantity; but if fine fibre must be produced, an additional quarter of a bushel may be added; when the seed is regarded, two bushels or two and a half may be sufficient to the acre. The quality of flax-seed is easily ascertained, and it is important that every farmer should be a judge of the different kinds. That which is fresh and proper for sowing should be smooth, slippery, bright, plump, and so heavy as to sink in water; it should also taste sweet, and, on being broken, it should appear of a light yellowish-green color, and oily.

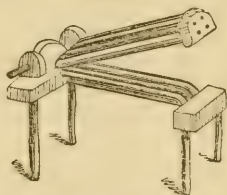
The after culture of flax is chiefly confined to weeding.

Gathering. — The state of ripeness at which the crop is to be taken up depends on the object in view in its cultivation. If to produce seeds, then a degree of ripeness is essential greater than when the quality of the fibre is the desideratum. In the latter case, it is well to pull the flax when it is somewhat green; in the former case, the state of ripeness is denoted by the seed vessels becoming hardened, the stems assuming a yellow hue, and the leaves beginning to fall. When the seeds are not intended for sowing again, though intended to be saved for consumption on the farm, the best period of pulling is shortly after the plants have attained maturity with respect to the formation, but not to the full ripening of the seeds. Flax should never be pulled when it is in the least degree damp; and, when it is pulled, the greatest care should be taken to sort it, keeping every kind by itself. When pulled up, the plants are bound into sheaves or bunches, binding with the flax itself.

Rippling. — In the process of rippling, which is the next operation, a large cloth should be spread upon the ground, with the ripple placed in the centre of it. The rippling machine (*Fig. 73*) is an instrument like a comb,

with iron teeth, fixed upon a plank. The flax is separated into handfuls, and then drawn once or twice through the teeth of the machine, and thus the capsules or seed-vessels are separated. These capsules or pods should be spread in the sun to dry; and those seeds which separate from the pods without bruising are the best and ripest, and may be set apart for sowing. The capsules are then broken, either by treading or threshing, and the seeds carefully winnowed and cleaned.

Fig. 73.



Watering. — The next process is the separation of the fibres from the stem by steeping the flax in water, by which the softer part partially undergoes the putrefactive fermentation; the best water being that which is clear, soft, and in standing pools. The bunches of flax should be built in the pool in nearly an upright position, the root-ends being uppermost. They are kept under water by means of stones. When the flax is properly watered, it will sink in the pool, and the fibres will separate freely from the stalk. In warm weather, eight or ten days will sometimes be enough, and only a few more, in any case; but, if the fibres adhere to the stem, so as to be separated with difficulty, it must be continued in the water longer. When sufficiently watered, it is taken out of the pool; and when drained, is taken to a grass field, and spread thinly over it in rows, lying on the grass not more than eight or ten days, and, when brittle, is taken up and again bound into sheaves or bunches, and then left till thoroughly dry, when they are sent to the mill, or carried home, or stored till wanted.

Uses. — Besides the fibre of the plant, its seed is of considerable importance, being highly nutritive, and beneficial to every species of animal. It is given in the form of a jelly, mixed with various other matters. Given to calves, it is an excellent substitute for milk; to horses and cattle it may be given, mixed with bruised oats, bran, or cut hay, and straw; but when intended for cattle, the chaff need not be separated from the seeds, but be all boiled together.

LUCERN.

Description. — This plant has a perennial root, and grows, when cultivated, from a foot and a half to two feet high, and more. It is covered with

leaves, downy below, and slightly so on the upper surface; bears a flower of a fine purplish violet, and flowers in June or July.

Fig. 74.



Soil.—The soil adapted to its growth is deep, and of the lighter class, with a free or kindly subsoil.

Culture and Tillage.—Two methods of raising this plant have been recommended and practised. The one is sowing it broadcast, in spring, sometimes along with a corn crop, in the same manner in which clover is sowed, and sometimes without a crop; and the latter is the better practice, lucern not being suited to grow freely under the shade of other plants. The other method is, cultivating it in rows. Lucern, like other cultivated forage plants, gradually gives place to the grasses and hardier plants. When cultivated in rows, and carefully hoed, these native plants can be kept down, and the lucern preserved for a long period in the ground. But, when sown broadcast, this cannot be done in the same degree, and the lucern does not generally endure beyond nine or ten years. This is the main advantage which the row system possesses over the broadcast, in the cultivation of this plant. The best period of sowing lucern is about the middle of April. When sown broadcast, the quantity of seeds to the acre may be sixteen or eighteen pounds; when sown in rows, ten pounds.

The soil should be well prepared, by deep ploughing, and a previous summer fallow, or fallow crop, such as potatoes, turnips, or carrots. But when it is wished merely to possess a few acres of lucern for the convenience of soiling, it is better to have the ground deeply trenched, and well manured.

When drilled, the rows need not be more than eighteen inches apart, which will give room for tilling the intervals by the horse or hand hoe. After

the seeds are sown, care must be taken to keep down, by means of the hoe, all weeds that spring up amongst the plants and in the rows. In the month of August of the first year, when in flower, the crop may be mown, and, after this first cutting, the shoots may be kept down, by a slight pasturing with sheep, but not while the soil is wet, nor continued till a late period. Early in the following spring, the ground is to be horse or hand hoed, so that all weeds may be kept down, and the earth stirred about the roots of the plants. In the month of May the crop will be ready for the first cutting. After being cut, it is to be horse-hoed in the intervals. It will now grow very rapidly; and, when ready for cutting, is to be cut again, and, after each cutting, hand-hoed. In this manner it may be mown four or five times in the season. It does not, however, arrive at its full growth till its third year, after which it will yield rich and early foliage. But it requires to be manured at intervals, as every fourth or fifth year; the manure may be farm-yard dung, spread upon the surface after the last cutting in autumn, or early in spring. When the system of broadcast is adopted, the difference in the method of tillage is, that, in place of horse and hand hoe, the common harrow is used, which, passing over the surface, stirs the soil about the roots of the plants, and drags up and destroys weeds; the lucern itself, having a strong root striking downwards, is not torn up by this rough treatment, but is benefited by the stirring of the soil around its roots and stems.

Uses.—This plant is eminently wholesome and nutritive. It is well suited for milch cows, causing them to yield good and abundant milk, and is perfectly adapted to the feeding of horses, which is one of the most common purposes to which it is applied. It may be used with the like advantage for the soiling of any kind of stock, and is valuable for the early feeding which it supplies, being in this respect considerably before the clovers.

SAINFOIN.

Description and Habits.—This is a deep-rooted plant, with a branching stem, bearing spikes of beautiful flowers. It grows wonderfully on rocky soils, stretching its roots to a prodigious depth amongst the crevices of rocks and open strata. It is, in truth, on dry rocky soils that the chief advantages of the cultivation of sainfoin are seen. Like lucern, although in a lesser degree, it is choked, and ultimately extirpated, by the prevalence of the grasses; but in a soil perfectly suited to it, as in a chalky down, it will have a duration, perhaps, as long as any other plant. Although best adapted to the limy soils, it will also grow upon any light soil which has a free or open subsoil; but on moist clays it will only last a few years,—sometimes not above two.

Culture. — Sainfoin may be sown with a crop, in the same manner as the clovers and grasses. In the following season, it may be mown for hay or green forage, although it does not attain its full maturity until its third year. When this mode of management is adopted, the sainfoin should be mixed with one or more of the clovers, the most suitable being white clover, which will add to the weight of the produce, without materially interfering with the growth of the sainfoin. It should be sown broadcast, rather than cultivated in rows, and the seeds should be of a good and tried kind, perfectly fresh.

Fig. 75.



It does not bear such frequent cutting as lucern. When used for soiling, it may be cut twice; when used for hay, it should be cut once, and the after-math depastured. It may be used for herbage as well as for forage, and many farmers prefer depasturing it in the first year, so that in the second it may have attained its full growth before it is mown. When made into hay, it should be cut just when it comes into full flower. It is not very apt to be injured by heating, and therefore may be put up more quickly than other hay plants.

If ground is to be mown for successive years for forage, then, on such soils as are suited to it, it is a good crop, being easily grown, hardy, and productive. Such a mode of cultivation, however, cannot be commended. When sown merely to produce one crop of hay, and then to be depastured for such a period as may be thought suited to the nature of the soil, it answers well; but in this case it is recommended that it be sown with a proportion of white clover and rye grass.

THE TARE.

Description. — This is an annual plant, hardy, and comprising **several varieties**, one of which is distinguished by producing yellow seeds. The

Fig. 76.



varieties are chiefly two, the winter and spring tare, in choosing between which, everything must depend on the intention of the crop. If the object is to have early feed, the winter variety is to be preferred; but where the land is foul, and requires to be two or three times ploughed in spring, or where a late crop is desired, or a crop for seed, then the spring variety will generally deserve the preference.

Soil. — The best adapted is a clay, but they will grow in any rich soil, not over dry. In a moist climate, the haulm grows so luxuriant as to rot at bottom; and in one over dry, it is deficient in length. A dry season is, on the whole, preferable.

Preparing the Soil. — This seldom consists of more than one ploughing, if for autumnal sowing; and of a winter and spring ploughing, when to be sown in spring.

Time of Sowing. — The winter variety is sown in September and October, and the first sowing in spring ought to be as early as the season will permit. The mode of sowing is mostly broadcast.

Culture. — The quantity of seed to an acre is from two and a half to three and a half bushels, according to the time of sowing, and whether they are to be consumed green or left to stand for a crop. When intended for seed, less is sown than when grown for soiling or drying the haulm.

CLOVER.

Varieties. — There are three principal varieties, — Dutch clover, purple clover, and cow-grass, the most approved kind being the common red or broad clover, which is extensively cultivated in the United States, some-

Fig. 77.



times alone, and occasionally with other grasses. With timothy it makes hay of a very excellent kind. especially for neat cattle.

Culture — The seed is usually sown with winter wheat or other grain crops, late in February or in March, whilst the ground is still subject to freezing and thawing, and the seed can thus gain admission into the soil. Or it may be sown with the oat, or other spring or summer crop, in which case, having the advantage of being harrowed in, it can generally be sown with even greater success than when put with a crop of winter grain. Too little seed is generally applied, the quantity required being from ten to fourteen pounds per acre.

Clover is frequently turned under in the fall, to enrich the ground preparatory to a crop of wheat, or in the ensuing spring for the benefit of Indian corn. The best time for turning down is in the rankest and most juicy stage of its growth. Being a biennial plant, clover, of course, leaves the field after the second year, unless allowed to seed itself. When timothy has been sown with it, it obtains possession of the field, where it is generally allowed to remain two or more years longer, affording the richest of all kinds of hay for horses, although for neat cattle the mixture of red clover and timothy is generally preferred.

Clover hay, when fed unmixed to horses, often produces a cough. This can always be removed by substituting timothy for a few weeks, after which,

the feed may consist of half clover and half timothy, with little or no danger of producing cough. When the clover hay is fed from large troughs or mangers, instead of racks above the head, horses escape the cough.

The first year's growth of clover is sometimes mown for hay and sometimes pastured, and the second crops devoted to hay and furnishing seed. When the second crop is pastured in spring, the stock must not be turned on before the ground has become so firm that hoofs will not sink into the sod, nor until the growth is such as to enable the cattle to thrive. The pasturage may be continued from the middle of April or first of May, for about six weeks, when the cattle are to be withdrawn, and the second crop allowed to go to seed for saving.

The common practice of spreading clover hay from the swath causes the leaves and blossoms to dry and crumble before the haulm or stems are sufficiently cured. In this way, either the finer parts of the hay are lost, or the crop is housed with so much moisture as to cause it to heat, and often to spoil. It should only be spread when it has become wet with rain in the swath, and should be gathered again before the leaves dry and crumble. Both these evils may be avoided, and labor saved, by curing the grass wholly in swath and cock. The clover should be left to wilt in the swath, and when partially dried, either to turn the swaths or to make grass-cocks the same day, so as to secure the dried portions from the dew. These grass-cocks are allowed to stand one, two, or three days, according as the weather is, and as the curing process has progressed, when they are opened at nine or ten o'clock on a fair day, the hay again turned over between eleven and three, and, soon after turning, gathered for the cart. Some care is required in making the cocks. The grass is collected with forks and placed on dry ground between the swaths, in as small a compass as possible at the base, say two or three feet in diameter, and rising in a cone to the height of four or five feet. The advantages of this mode of curing clover are—1. The labor of spreading from the swath is saved. 2. The labor of the hand-rake is abridged, or may be wholly dispensed with, if the horse-rake is used to glean the field when the hay is taken off. 3. It prevents, in a great measure, injury from dew and rain; for these cocks, if rightly constructed, (not by rolling,) will withstand a rain of some days, without heating, or becoming more than superficially wet. 4. Clover hay made in this way may almost invariably be housed in good condition; and, if rain falls after the grass is mown, the quality of the hay is much superior in cocks to what it would be under the old process of curing.

Many prefer mowing the clover before it gets very ripe, as then so much of the seed would not be shaken off during the operations of curing, removing, &c. As the hay of the seed-crop is seldom considered of much value,

except for litter and manure, it is frequently left long in the field to become thoroughly dry, so as to insure it against heating in the mow or stack, as this would be far more injurious to the seed than exposure to weather. Besides mowing the seed-crop in the usual manner for hay, several other methods have been devised. The one most usually resorted to in Pennsylvania is the employment of a scythe and cradle to cut off the heads, which are caught by a kind of bag attached to the lower fingers, the rest being removed. Or, the upper fingers being removed, the lower ones may be placed sufficiently close to catch the heads. Many contrivances are in use for gathering the heads in the field.

In getting the seed from the heads, it has been common to employ the flail; and, to clear it from the husk and chaff, recourse has been had to a clover-mill, worked either by water, steam, or horse power.

The old method of threshing out clover-seed by the flail, or by the tramping of horses, has been generally regarded as very tedious and disagreeable; so much so, indeed, as to have discouraged most farmers from attempting to gather the seed at all; but the introduction of threshing-machines has obviated all difficulty of this kind.

THE GRASSES.

Varieties. — The species of grass which may be regarded as most valuable in our meadows and pastures are: — 1, Meadow or green grass; 2, Timothy; 3, Orchard grass; 4, Meadow fescue; 5, Blue grass; 6, Ray grass; 7, Red-top; 8, Sweet-scented vernal grass. These, among the almost infinite varieties, are considered about the most valuable

Fig. 78.



First, — *Meadow or Green Grass*, also called *Spear or June Grass*, highly esteemed for hay and pasture. It is a native variety, and abounds through

the country, but does not perfect itself north of the Ohio valley. It withstands the frost, and prefers a warm, dry, limy, or rich upland soil.

Second, — The *Timothy*, *Cat's Tail* or *Herd's Grass*. For the Northern States this is unsurpassed, flourishing in all soils except such as are wet,

Fig. 79.



too light, dry, or sandy; is easy of cultivation, hardy, and very productive. For milch cows and young stock, it should be cut while it is juicy. May be sown upon wheat or rye, in the spring or early fall.

Third, — The *Orchard Grass*, or *Cock's Foot*, a native variety, well suited

Fig. 80.



to good arable lands. Should be cut before wholly ripe, and be fed closely. Will grow in all parts of the United States.

Fourth, — The *Meadow Fescue*; likes a rich, boggy soil, is quite produc-

tive and forward, the grass being of a kind much relished by cattle, either green or hay.

Fig. 81.



Fifth,—The *Blue Grass*, or *Flat-stalked Meadow*; an early dwarfish grass, growing in the Middle and Northern States. It is hardy, but is more valuable for pasture than hay.

Sixth,—The *Ray Grass*, or *Rye Grass*; extensively grown in some parts

Fig. 82.



of Europe, but does not do so well in this country, except in elevated and humid districts.

Seventh,—The *Red-top*, *Herd's Grass*, *Fowl Meadow*, or *Fine Bent*; a native perennial variety, valuable for hay and pasture, on lands adapted to its growth, which are reclaimed swamps and other moist grounds. This

grass and timothy are fit for the scythe about the same time, and, therefore, fit to be sown together.

Fig. 83.



Eighth, — The *Sweet-scented Vernal Grass*. This is a foreign perennial grass, of dwarfish habit, sown principally on grounds intended for pasture,

Fig. 84.



on account of the very early feed it affords, and for its growing quick after being cropped. It is delightfully fragrant.

Fig. 85.



In addition to the preceding varieties, there is the *Pony Grass* (Fig. 85), which is considered one of the best winter grasses for the Western States,

grows in close, thick, elevated tufts, and continues green through the cold season.

Annual Spear Grass is an early, sweet grass, much relished by cattle; but it will not stand drought.

Barn, or Barnyard, Grass flourishes on moist, rich, or well-manured soils, is very succulent and nutritive, and well relished by stock. Flowers in the latter part of summer, and beginning of autumn.

Black Grass grows luxuriantly along the margins of salt marshes liable to periodical overflow by the tides. When cut early, and well cured, it makes a very excellent hay, although not equalling in weight that of many other varieties.

Crab Grass, a native of India, now grown in the United States, is an early grass, which requires a moist, rich soil.

Crested Dog's Tail Grass grows well in upland pastures, and affords a wholesome food for sheep. It flowers somewhat late, and makes a beautiful covering for lawns in the latter part of summer.

Crow-foot Grass, another native of India, naturalized in the United States, succeeds well. It grows well in a moist, rich soil, and makes excellent hay.

Downy Oat Grass is a hardy plant, and forms a good, permanent pasture. It is common to chalky soils; but arrives at greater perfection on more fertile lands, which it impoverishes but little.

Fiorin, or Bent Grass, an imported English variety, grows vigorously in moist soils and swampy grounds. Sheep and cattle are very fond of it. It does not suit for alternate husbandry, as, when once it has obtained a hold, it can scarcely be eradicated.

Floating Fescue Grass flowers in June, and delights in very wet grounds. Horses and cows are very fond of it, and the superior excellence of some kinds of cheese is said to be caused by the peculiar richness and flavor which it imparts to the milk of cows fed upon it.

Foxtail Grass very much resembles timothy, for which it is sometimes mistaken. It is extensively grown in the Middle States, and flourishes on any fertile soil, which is not wet.

Gama Grass, a native of the Southern States, is one of the most prolific grasses under cultivation, and will bear drought when all surrounding vegetation is destroyed. If suffered to go to seed it becomes too coarse for hay; but, in its green state, it is eaten by cattle with avidity.

Guinea Grass, a native of Africa, naturalized in the United States seventy years since, but now little cultivated, was formerly much esteemed in the South, as a most prolific and nutritive grass. It is a perennial plant, and may be cut four or five times during the summer.

Italian Rye Grass flourishes best on fertile, well-watered soils; but, notwithstanding its great trans-Atlantic repute, it does not equal timothy in its nutritive qualities.

Meadow Spear Grass flowers late in June, and, being a hardy plant, succeeds as well on low, wet grounds, as it does on light, upland soils. It is eaten readily by cattle during the winter season, though it is not much esteemed because of its coarseness.

Meadow Foxtail is a perennial grass, of early growth and hardy nature, much relished by sheep and horses. It grows well on soils which are in good condition, and is very productive, continuing to shoot forth flowering stems until late in autumn.

Narrow-leaved Meadow Grass forms a fine, permanent pasture. It flowers in June, and, before that time, its leaves, which are soft and succulent, attain the length of twelve inches.

Reed Meadow Grass, which grows in wet soils, contains much nutriment, and is greedily eaten by cattle. It is too aquatic in its habits to allow of an extended culture.

Ribbon Grass is well adapted to wet, boggy grounds, yields a large product, either in hay or pasture, and is much relished by cattle. Being essentially aquatic in its nature, it requires a soil well saturated with water.

Rice Grass flourishes in swampy lands in the South, may be cut several times during the summer, and furnishes a hay fully equal to the best timothy.

Salt-marsh Grass grows in muddy spots, overflowed by sea-water. Cut green, and made into hay, it furnishes good food for horses and cattle, which eat it with a relish, on account of its saline flavor.

Sheep's Fescue forms an excellent pasturage for sheep. It grows from six to ten inches high, and flowers in June.

Smooth-stalked Meadow Grass makes an excellent hay, and affords the richest of pastures. It delights in a moist soil, but thrives most luxuriantly in rich meadows. It is useful for making a straw plait, which very closely resembles Leghorn.

Tall Fescue Grass, a native perennial, is very luxuriant and productive, but not a favorite on account of its coarseness. It grows well in boggy meadows, and flowers in July.

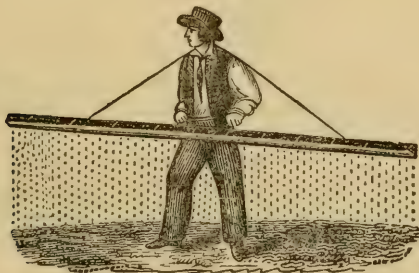
Tall Meadow Oat-Grass, which blossoms in May, is preferred by horned cattle before all other grasses, and yields an abundance of good, sweet hay. Mixed with clover, it makes a good upland meadow.

Lands alternately in Grass and Tillage.—In laying down lands to grass, the most important primary object is duly to prepare them for the recep-

tion of the seeds. The soil ought to be brought into the highest possible degree of fertility; for, although land may be too rich for the production of some crops, it is quite otherwise in the case of grass. Besides being rich, the land should also be well pulverized by tillage; otherwise, the irregularity of the surface will not only occasion an irregularity in the produce of the crop, but it will be liable to be damaged by excessive droughts, before the plants can have extended their roots, or become firmly settled in the land.

The time of sowing the seeds of the cultivated grasses depends on the nature of the land, the state of the weather, and the kind of crop amongst which they are sown. Among the numerous inventions for sowing seed broadcast, the one here figured is very simple and convenient. When

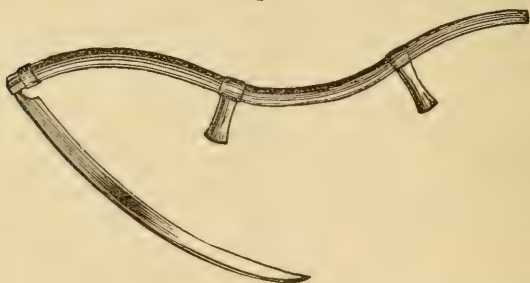
Fig. 86.



sown with corn, the seed-time is invariably in the spring. The autumn is preferable when they are sown exclusively by themselves. This practice has been recommended, in the case of laying down lands to permanent grass, as being calculated to afford a thicker and better sward. The value of the grass crop is, no doubt, in some degree, affected by the exhaustion of the soil occasioned by the production of the preceding crop of corn, but not in a degree commensurate with the latter; besides, the period in the rotation at which the smaller seeds should be sown is immediately after the land is manured, and, in this case, the severity of the corn crop is felt. After being sown, the seeds quickly germinate, and, in favorable situations, they will have attained a considerable height before the commencement of the corn harvest; and when the corn is cut down close to the ground, they are cut and winnowed with the straw, and add considerably to the value of the latter for fodder. After harvest, the ground may be slightly pastured with calves and sheep; throughout the

winter the land is to remain untouched. In the succeeding spring, clear the land of stones, and afterwards the surface is to be raked to break down the stubble of the preceding crop, and further to prepare the land

Fig. 87.



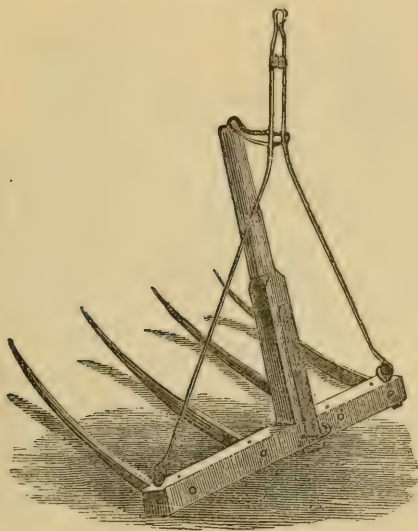
for the action of the scythe towards the first of June. When, however, the crop is set apart for pasturage, the earliest and richest herbage is to be obtained in the second year.

Soiling.—When the practice of soiling, or cutting the crop and consuming it in a green state, is pursued, the part containing a large quantity of the clovers should be chosen, while that in which the grasses predominate may be made into hay. The crop may be cut for soiling earlier than for hay. Soiling is, in many cases, advantageous; in others, it is not. Certain animals do not thrive unless enjoying the air and exercise attendant on pasturage, and, in most cases, a portion of the farm is unavoidably in pasture, as, for instance, grass land in the second and third year. Soiling and depasturing may be somewhat combined by turning animals out to the pastures during the cool parts of the day, and feeding them in the house towards noon.

Haying.—The portion of the crop which is not cut for soiling is made into hay. The period when the crop should be cut down, when intended for hay, is just when the plants have attained their full size; and the flowers, which just then are coming on, should not, in any degree, have begun to fade before the crop is cut down. The plants are laid in swaths by the action of the scythe, and as soon as these are dried on the top, they are completely turned over by a fork in such a manner as not to break or spread, and these swaths may be put into cocks in the evening, which are afterwards made into ricks, or conveyed to the stack. When not dry enough to be carried from the small cocks to the stack, it must

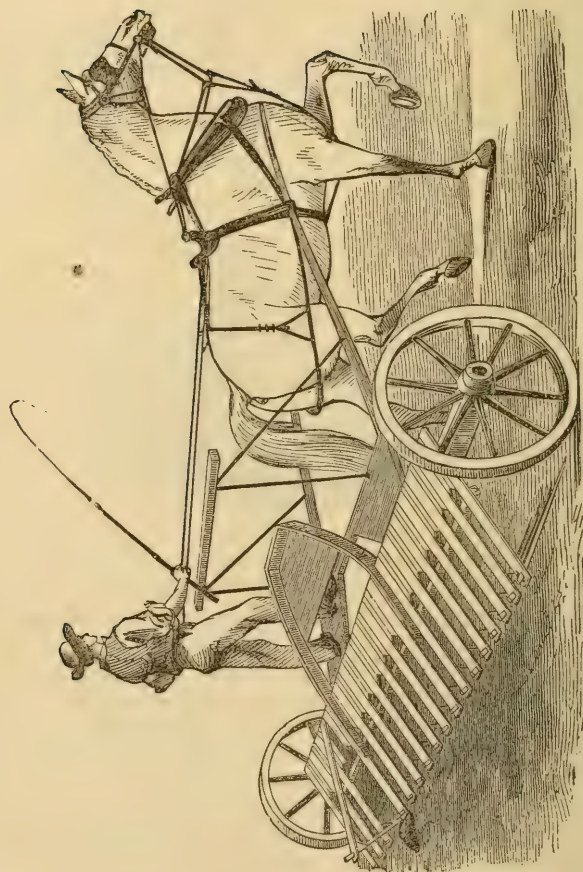
be formed into large cocks or ricks in the field, there to stay until fit to be stored in a larger stack. By the use of a hay-elevator (Fig. 88), a load

Fig. 88.



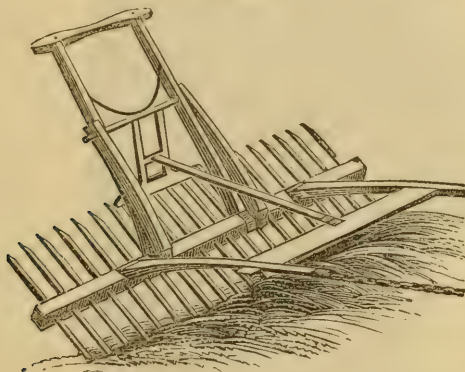
of hay may be transferred from a wagon to the mow or stack in a very few minutes. In forming the stacks, a layer of straw is usually spread over the bottom, or stand, and the hay is then regularly spread and trodden down, observing to keep the middle of the stack well raised. In this manner, it is carried up to the height of several feet, projecting slightly to the eaves, so as to overhang the sides, to guard the lower part from rain. The roof is then raised to a considerable height in a slanting form, with gable ends; and, being thus formed, the loose hay which projects from the sides and ends of the stack is pulled, until all is smooth and regular, and the stack is then bound down with ropes. Salt, in small quantity, is sometimes strewed upon the hay, as the building of the stack proceeds, to stop fermentation, and render the hay palatable. Immediately after the hay is removed from the field, cattle may be turned in for several days. The length of time which the land is afterwards continued in grass depends on the course of cropping practised on the farm. According to the alternate husbandry, it cannot be longer than one or

Fig. 89.



two seasons, for, under any circumstances, it is not good management to keep land more than three years in grass. The revolving horse hay-rake

Fig. 90.

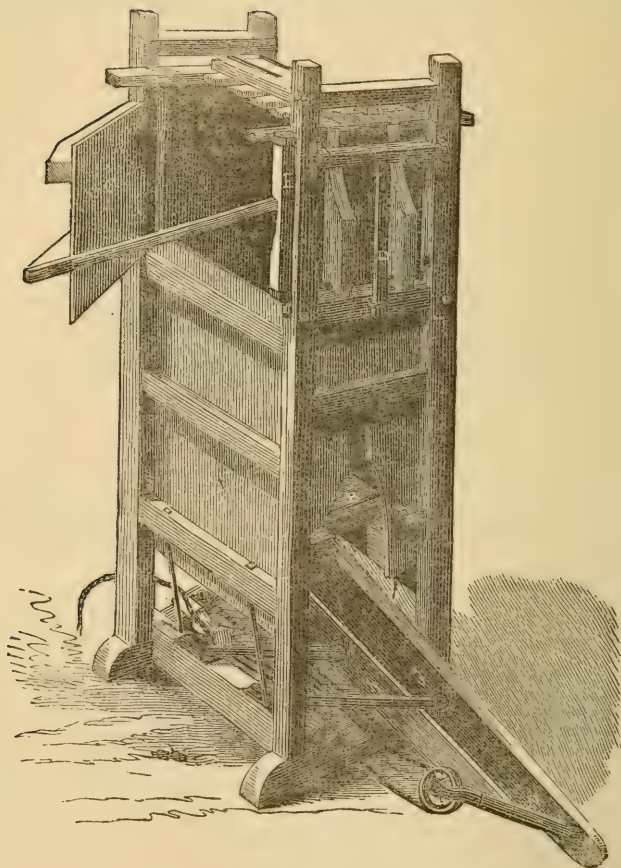


(Fig. 90,) was formerly in extensive use, but it has been in a great measure superseded by more labor-saving machines, of which Delano's movable tooth-rake (Fig. 89,) is one of the best.

Hay-Caps.—So much hay has been injured in the fields by rain, after it has been fully cured, that it has been found economical to make covers, and spread them over the hay-cocks, as a protection from the weather. These, styled "hay-caps," are made of stout, unbleached sheeting, forty-five inches square, well coated with a mixture composed of one gallon of linseed oil, four pounds of beeswax, and one quart of japan. A stone sewed into each corner, to prevent it from being blown off by the wind, is then the only thing required to complete the article for use. Larger-sized covers, made in the same manner, are used for the protection of hay while on the wagon, or in permanent stacks.

Pressing Hay.—A variety of machines have been used for the purpose of packing hay in bales for market, all of which have some merit. That illustrated in Fig. 91 (Dederick's), one of the latest inventions, is believed to be more perfect than any heretofore employed. There being no unnecessary friction to overcome, the power is proportionally increased. This machine is also used for packing cotton, hops, hemp, cloth, etc. Instead of being obliged to build a press, farmers may now have them made to order with as much facility as any of the other labor-saving machines.

Fig. 91.



Lands Permanently in Grass. — The management of lands of this description is somewhat different from that of grass land merely interposed in the course of cropping of arable lands, to prevent the exhaustion of the nutrient parts of the soil consequent upon incessant tillage. From the short period in which the land is, in the latter case, in grass, manure is seldom applied to the surface, though often indispensable in the former. Various other operations are also performed to remedy those defects which

are natural consequences resulting from lands being long kept in grass. Such lands naturally divide themselves into two classes—those fit either for mowing or pasture, and those fit for pasture only.

Perennial Grass Lands fit for Mowing, or Meadow Lands.—Under the term meadow are included all such lands as are kept in grass chiefly for the sake of the hay-crop, though occasionally, and at particular seasons of the year, it may be depastured. The value of the natural meadow depends much on the situation, as well as on the quality, of the land. There are three descriptions of these meadows; those on the banks of streams and rivers, those on the uplands or more elevated grounds, and bog meadows.

The meadows situated along the banks of rivers and streams are, in general, by far the most valuable, and should never be converted into tillage. The principal defects to which such lands are liable, are the oozing out of the springs towards their junction with the higher grounds, and the overflowing of the stream or river: the former evil is to be remedied by draining, and the latter by supplying embankments, well fortified with osiers.

Upland meadows require more attention than valleys and holms, being more difficult to drain, and requiring frequent manuring. The roots of grasses never strike deep into the soil; and thus, deriving their nourishment chiefly from the surface, the utility of top-dressing is obvious. The irregular surface of uplands is frequently much injured by superfluous moisture, and the surface is generally covered by inferior herbage and by mosses, the remedy for which consists in a very thorough course of tillage.

Boggy land is generally least valuable. When thoroughly drained, the culture of herbage plants is about the most profitable way of occupying it. When under tillage, its cultivation is very difficult; but when so far improved as to warrant its being laid down in grass, large crops may be obtained at comparatively small expense.

More than one crop is rarely obtained from the natural meadows. The time of cutting the crop is later than that of the cultivated meadow, the proper time being just before the formation of the seed. After being cut, the grass is allowed to remain for a short time in the swath, and is then scattered evenly over the surface of the ground. If the weather be fine, the grass is soon formed, with the rake, into what are called wind-rows, which, after standing a few hours, may be formed into cocks of small size, by simply grasping a quantity of the grass, which had been previously shaken in a heap, and placing it on a part of the surface that

has been raked. The next day these cocks are again spread abroad, then formed into wind-rows, and again put into cocks, of a larger size, in the evening. In a day or two these will be ready for putting into ricks, if the weather be fine; if it be not, a much longer time may be required, and the cocks will have to be again shaken out and re-formed into larger, before the hay is ready for the rick.

In certain situations, the raising of hay on the natural meadow will be found the most simple and economical way of occupying such lands as are suited to it. Frequent manurings are, however, essential to their productiveness; the best manure being composts of lime, to be applied in the spring.

Permanent Pastures. — The drainage of lands permanently in grass greatly improves them. Cuts are made along the hollows of the field, which convey the water to the most convenient outlet, and small drains, formed either by a plough or spade, open into them. These need not be more than a foot deep, though numerous, especially in hollow places. Having drained off the surface water, the tendency to rot will be obviated. Weeds, shrubs, and mosses should be thoroughly removed, which can be done by the hand, by the use of the plough, by draining, and by a course of tillage.

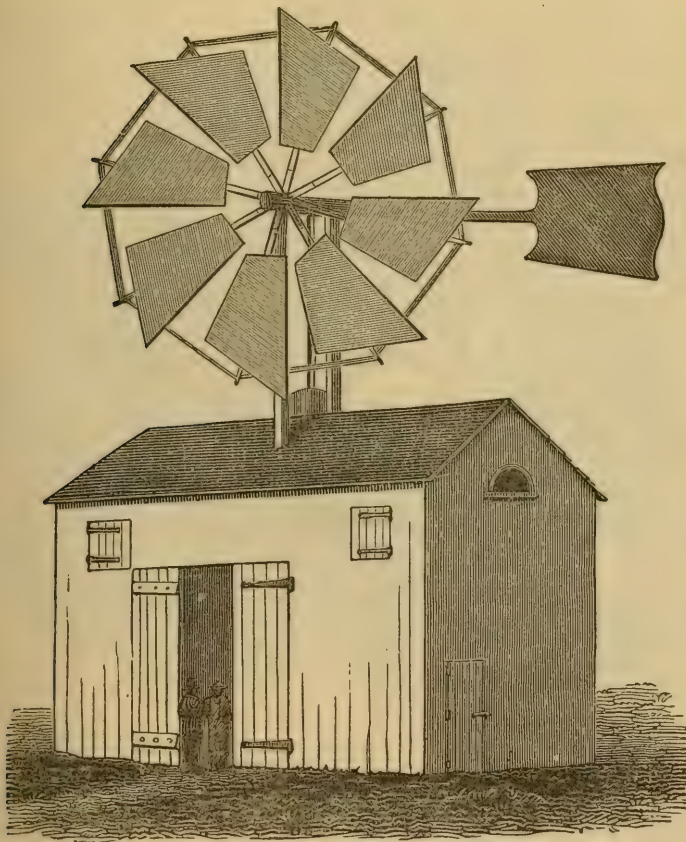
Lime, applied to the surface of grass lands, either alone or combined with other matters, is beneficial, after superfluous moisture has been removed. When, from frequent rolling and the treading of animals, the surface of grass lands gets into a tenacious state, scarifying will go far to remedy the evil. This operation is quite useful before any top-dressing is applied.

The time of stocking pastures in spring must depend on the season; and the state of growth which it is desirable the plants should attain before being stocked must, in some degree, be determined by the condition and description of the animals to be employed in consuming the herbage, — whether they are only in a young state, or approaching to fatness, — whether milch cows or sheep, or a mixture of animals of different species. The great objects to be aimed at are, that the stock, of whatever kind it may be, shall be carried forward faster or slower, according to the object in view, and that none of the herbage shall be wasted.

MOTIVE POWERS, ETC., FOR FARM PURPOSES.

The Wind-Mill is one of the most economical motive powers which can be used upon a farm, as, if the machine is well made, on a good principle, it requires no repairs for some years, and then only those of the most simple and inexpensive character. The most perfect, yet simple,

Fig. 92.

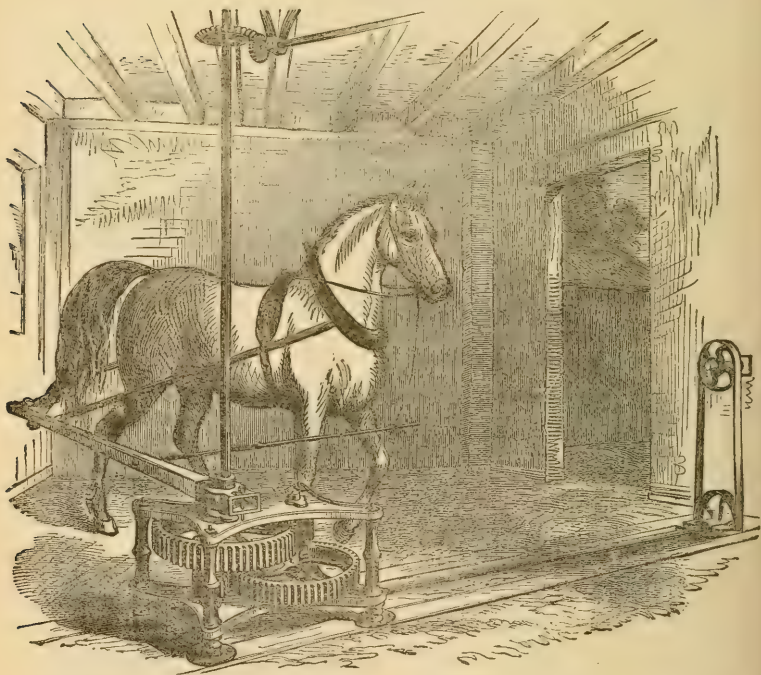


wind-mill now in use in the United States, is that of Mr. C. R. Webb, Philadelphia (Fig. 92), which, with a moderate breeze, will grind eight

bushels of grain per hour, and, at the same time, raise water to the height of from fifty to one hundred feet. Being self-regulating, it can be started or stopped by even a child, without going outside of the building on which it is placed.

Horse Power.—Fig. 93 represents a vertical horse-power, which may, however, be geared for a horizontal movement, if preferred. It is adapted

Fig. 93.

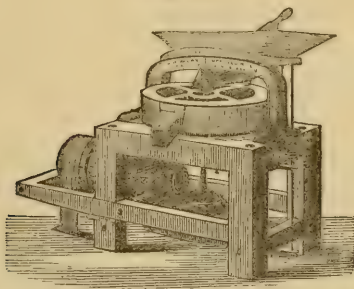


to one or more horses, as may be required, and is a compact, durable, very simple, and cheap power. It may be used for driving a threshing-machine, for supplying power to a portable or stationary grist-mill, and for all the various purposes to which the wind-mill is applicable.

Patent Grist-Mill.—Beside grinding all kinds of grain into flour, these mills (Fig. 94) are calculated for supplying feed-stuff of any required

fineness. These machines are so simple that they can be regulated by any person of ordinary capacity ; and, according to size, they will grind

Fig. 94.



from seven to twenty-two bushels of corn per hour. Any kind of power can be applied to them, whether wind-, water-, steam-, or horse-power.

CHAPTER III.

PLANTS CULTIVATED FOR THEIR USES IN THE ARTS, AND FOR THEIR OILS.

INDIGO—MADDER—WELD—WOAD—TURMERIC—SUMACH—BASTARD SAFFRON
—TEASEL—COLZA—RAPE—SUN FLOWER—CASTOR OIL PLANT.

INDIGO.

Description.—This is an extensive genus of rather elegant plants, with tap roots, most of the species of which produce the well-known dye called indigo, the finest of all vegetable blues. The genus belongs to the natural order *Leguminosæ*; the flowers resembling those of the pea tribe. The upper petal is round, and notched at the point; the two lower petals furnished with an awl-like spur on both sides; the stamens are united in two parcels; the style is thread-like; and the fruit, shaped like a peapod, is divided into two parts, containing one or more seeds.

Fig. 95.



Varieties.—The varieties cultivated are: the wild (*Indigofera argentea*), the Guatemala (*I. dispermea*), the French (*I. tinctoria*), and the *I. caerulea*, which yields the finest indigo.

Soil.—When cultivated, indigo thrives best in a free, rich soil, and in a warm situation, frequently refreshed with moisture. In the West Indies it may be grown on comparatively poor, dry soils, but to most advantage

in those that are fertile. In the Southern States, however, the plant requires a good, rich, deep soil. These States are peculiarly adapted to the culture of the indigo plant, and, a half century since, the finest indigo ever produced was grown in the Carolinas.

Culture. — The ground having been first properly mellowed with the plough, and then harrowed, the seeds may be sown with a drill, in rows distant from each other about twelve or fourteen inches. As the plants shoot up they must be frequently weeded, and carefully tended, until they spread sufficiently to cover the ground. When cultivated in great quantities, the seeds are merely strown rather thickly in little shallow pits, hoed up at a distance of six or seven inches apart, and immediately covered with earth. Plants thus raised thrive rather better than those sown in drills, but they require more care in weeding. They arrive at full perfection in two or three months, and answer the purpose best when cut in full blossom. With a reaping-hook they are cut off a few inches from the root, tied up in bundles, conveyed to the works, and laid in the steeper by strata. Four bushels of seed will sow twenty acres, and that quantity of land may be cultivated by sixteen hands. From rich land, the yield in twelve months will average five hundred pounds of indigo to the acre; for, if kept free from weeds, the plant will yield three or four crops each year, as it ratoons, or sends up new shoots after each cutting. It must, however, be replanted every season.

Extraction of the Dye. — When the lower leaves begin to dry, and while the morning dew is still on them, the plants are cut, and immediately immersed in vats, where they remain until macerated. The liquor is then drawn off into another vat, in which it is beat until the fecula separates, when the latter is let off into a third vat, and allowed to stand for some time. It is then strained through cloth bags, and afterwards evaporated to dryness in shallow wooden boxes, placed in a shady situation. Before becoming quite hard it is cut into square pieces, and packed in cases for shipment. Indigo is not contained ready formed in the plant, but is produced by the oxidation of some substance there present. Fermentation is not essential to its extraction, as a mere infusion of the plant in hot water deposits indigo by standing in the air. The only solvent of pure indigo is sulphuric acid, with which it forms a deep blue pasty mass, soluble in water, and largely used in dyeing. For the manufacture of indigo on a small scale, ordinary barrels will supply the place of vats; and holes bored in them at regular intervals from top to bottom will serve to draw off the liquor as required.

Uses. — The coloring matter of indigo is largely used in manufactures, principally for dyeing woollen and cotton fabrics, and for coloring mo-

rocco. Large quantities of an inferior article are annually imported, which would not be the case if the plant were cultivated in the South to the same extent as formerly. Manufacturers would abandon the use of the imported article if they could obtain the home product in sufficient quantity, as it is vastly superior to any which can be obtained from abroad. Beside yielding indigo, the *I. tinctoria* is also medicinally employed, and the powdered leaf of the *I. anil* is used in some diseases of the liver.

MADDER.

Description.—Dyer's madder (*Rubia tinctorum*,) has a perennial root, and an annual stalk. The root is composed of long, succulent fibres, as thick as a man's little finger, which strike deep into the ground, sometimes extending to a distance of three feet. From the upper part of the root many lateral fibres diverge, which extend to a great distance, just beneath the surface of the ground, and then send up numerous shoots, which, if carefully removed in the spring soon after they appear above ground, and replanted elsewhere, will furnish new plants. The leaves are four or six in a whorl, lanceolate, with the midrib on the under disk, and the margins aculeated. The flowers, which are small, are supported on axillary tripartite flower-stalks. The dried root is long, of a cylindrical character, about the bulk of a goose-quill, branched, and invested with a reddish cuticle, which, as well as the bark, is readily separable. In a fresh state the color is yellow, but by drying it becomes reddish. It has a feeble odor, and a bitter, astringent taste. The best coloring matter is prepared from the heart of the root, and the older roots are preferable to the young ones.

Soil.—The soils most suitable for the growth of madder are deep, fertile, sandy loams, containing a considerable infusion of lime and vegetable matter, and not retentive of moisture. It will grow in light soils, if they are fertile, and of sufficient depth, provided they are well manured.

Culture.—Plough the land deep in September, and again in October, and thus let it lie in ridges during the winter, to be acted on by the frost. When the spring has opened, and the ground become dry and warm, plough again deeply, and harrow well. Then strike the land off into ridges with a one-horse plough, making them three feet wide, with water-furrows four feet in width between. If the ground is moist, raise the ridges ten or twelve inches above the natural surface; but, if it be dry, six or eight inches elevation will be sufficient. A light harrow may then be used to level and shape the ridges. The time for planting is usually during the month of May, or even earlier, if there is no danger of severe

frosts. The land having been prepared as above indicated, stretch a line lengthwise of the beds, and, with a hoe, make holes six inches from the edge, along both margins of the beds, and also in the middle, leaving a space of twelve inches between each hole. Into these insert the sets, and cover them from two to four inches deep with fine earth, and press it down with the foot. As soon as the young plants appear above ground, they must be carefully hoed, with the view of destroying the weeds; and this must be repeated as often as the weeds reappear. If any of the sets have failed to grow, the vacancies may be supplied during June or July, by taking up and transplanting parts of the strongest roots. When the plants have attained the height of ten or twelve inches, the tops must be covered, with the exception of their extreme ends, with fine earth shovelled from the alleys. They should be bent outward as well as inward, so as to fill all the vacant spaces, and this operation should be repeated as often as the plants become sufficiently long, which is usually three times during the first season. The purpose of this is to assist the plants to form new roots, with which it is desirable to fill the ground as fast as possible. The *second year* the beds must be freed from weeds, and the tops of the plants covered with earth as before, which may be repeated two or three times during the season. Care must be used to keep the edges of the beds as high as the centres; otherwise, the rains will run off, and the crop suffer from drought. The *third and fourth years* but little attention will be required, as the plants cover the entire ground, and the few weeds which may appear can be readily picked out. The roots are ploughed out during September of the third year in some States, and during the same month of the fourth year in others: those grown in warm latitudes arriving at maturity much sooner than those cultivated in colder situations.

Ploughing out the Roots.—The tops of the plants must first be removed with a sharp-edged shovel, which takes off, at the same time, about half-an-inch of the surface earth. Then attach a powerful span of horses to a large plough, and turn a furrow outward, beam deep, around the edge of each bed, and let the hands rake and pick out the roots from the furrow. Plough another furrow beam deep, as before, inside of the last, and thus proceed until the beds have been entirely turned over.

Cleansing and Drying the Roots.—As soon as possible, take the roots to some running stream in the vicinity, or to the pump, and put them, half a bushel at a time, into a large, open-mouthed sieve, and wash them perfectly clean. When washed, lay them on slanting platforms to dry. These platforms should be about two feet high at one end, and slope down to eight inches at the bottom, and be erected in rows, not far from the

farm buildings. After the second or third day's drying, the roots must be protected from dews at night, and from rain, by placing several of the platforms one upon another, and covering the upper one with boards. In the morning, or when danger from rain has passed, they may be again spread out. In five or six days they will be sufficiently dry to stow away, preparatory to grinding. Some prefer drying in kilns, like those used for malt or hops.

Grinding the Roots.—As soon as the roots are thoroughly dried, they may be broken in a cast-iron bark-mill, and then cleansed by a fanning machine, after which they may be ground fine in a grist-mill, and packed in barrels like flour. If not packed immediately they gather dampness from the atmosphere, which prevents them from grinding freely. The addition of a little carbonate of lime while grinding improves the color considerably.

Propagation and Preservation of Sets.—Sets may be produced by sowing the seed in a fine, light earth, one year before the plants are wanted, and then transplanting them. Sets of one inch in length may be planted for one year in a garden, and then removed to the field-bed. The selection of sets from the growing crop should be made when it is dug in the fall. Those which grow horizontally, and have numerous eyes, are regarded as the best, and should be separated from the lower roots, and buried in the cellar during the winter. Previous to planting, they should be cut into pieces containing from two to five eyes each.

Uses.—Madder is a principal ingredient in nearly all the dyes used by calico printers; and for woollen goods it furnishes blue, black, purple, red, buff, orange, olive, yellow, brown, and many other colors. The profit of the crop is immense, and the market not easily glutted. The haulm has been sometimes fed to cattle; but it is rarely used, as it tinges with a red color, not only the milk, but also the urine, the perspiration, and even the bones. It was formerly used as a medicine for the cure of jaundice, but it is now known to possess no curative properties whatever.

WELD.

Description.—Weld, a native of the south of Europe, is an imperfect biennial, with small, fusiform roots, and a smooth, wand-like, leafy stem, from one to three feet in height. The leaves are dark green, linear-lanceolate, single-ribbed, obtuse, and entire: the flowers, which blow in July, are small, greenish-white, without much smell, and grow in large terminal clusters, which are many-flowered. It belongs to the mignonette family (*Resedaceæ*), and is sometimes found in earth brought from a great

depth, as the rubbish of coal-mines. Weld is cultivated for the sake of its stalks, flowers, and leaves, which afford a fine yellow dye, used for the coloring of cotton, silk, wool, and other substances. In conjunction with indigo, it forms a beautiful green; and it is preferred to all other dyes for the production of a lively green lemon-yellow; but the material to be colored must first be prepared with a mordant of alum and cream tartar, in order to render the yellow permanent. It is the most easily cultivated of all the plants used for the preparation of dyes.

Soil.—It grows on a great variety of soils, but fertile loams produce the best return. It is rather an exhausting crop; for which reason it has never been very extensively cultivated.

Culture.—The soil is usually well prepared, by ploughing and harrowing, and the seed sown, either broad-cast or in drills, during the month of May, or later, and lightly covered. From two quarts to one gallon is sown to the acre; and, if the seed is not very fresh, it is steeped in water for two or three days previously. It is also cultivated in the same manner as the grasses, being sometimes mixed with clover and grass seeds, and plucked out from among them when it is in flower. Sown among corn, on very rich soils, it occasionally answers very well, provided that the plants are weeded, hoed, and the ground well stirred, as soon as the corn crop has been removed. The drill system is, however, much the best; the drills being made twelve inches apart, and the plants, after they shoot up, thinned out until they stand at six inches distance from each other in the row. They then admit of cultivation in the usual mode.

Gathering the Crop.—The plants flower in July of the second year, and the proper period for pulling them is when the bloom has been produced the whole length of the stems, and the plants are just beginning to turn of a light, or yellowish color. The plants are pulled up by the roots in small handfuls, which are tied round with a wisp of straw or one of the stalks, and set upright, in stacks of four or five bundles each, to dry. When sufficiently dry, which is usually in about a fortnight, they are bound up into larger bundles, containing sixty handfuls each, and weighing about fifty-six pounds. Sixty of these bundles constitute a load. In this state the plants are ready for sale; or they may be stacked and preserved for a number of years, without injury.

Value of the Crop.—The produce varies according to the nature of the season, from half a ton to two tons per acre; and its cultivation sometimes yields a large profit—but the demand is uncertain, being sometimes very trifling, and at others so great as to raise the price to a very high figure.

Saving the Seed. — For this purpose a sufficient number of the largest and healthiest plants are set aside, and left stand until the seed are perfectly ripe. The latter are very easily separated.

Uses. — It is used in dyeing for imparting a yellow color to cotton, woollen, mohair, silk, linen, etc. Blue cloths are changed to green by being dipped in a decoction of it, and Dutch pink owes to it the yellow color which is its peculiar characteristic.

WOAD.

Description. — The woad (*Isatis tinctoria*), one of those plants which yield the deep-blue coloring matter so greatly valued in the arts, was most extensively cultivated in Europe previous to the introduction of the indigo of commerce. It is a very hardy triennial plant, with a hairy, branching stalk, which rises to the height of from three to five feet, very leafy, and paniced at the top. The panicle is composed of many compound racemose branches, covered with minute lanceolate leaves, which, as also the stalks, have a yellow color. The leaves, which are numerous, and small, are also of a bright yellow. The root of the plant is tapering and fibrous.

Soil. — A good crop may be obtained upon alluvial soils, but strong soils are preferable, provided they are not too much inclined to clay. Wet, moist lands will not answer; and the plant flourishes best in a rich, deep, mellow soil, such as may be found along the borders of large rivers, more especially if the latter is broken up for it immediately from a state of sward.

Preparation of the Soil and Culture of the Plant. — The ground is usually ploughed deeply in the fall, reploughed in the spring, and cross-harrowed; but as by this method it is next to impossible to reduce the old turf in one year, and the plants are endangered by the attacks of the grub and wire-worm, paring and burning are resorted to where the sward is rough, and abounding with rushes and sedge-grass. The seed is commonly sown from March to July; though early sowing is preferable, as the plants come up stronger, and yield a larger return during the first season. The seed is generally sown broadcast; but a better method of planting is in rows, allowing a sufficient space between each to admit of the use of a cultivator. For broadcast sowing from five to six pounds of seed are required to the acre; but when drilled in, two pounds are amply sufficient. When procurable, new seed is always to be used in preference to old, which is steeped some time before being put into the ground, to facilitate its germination. The after-culture comprises the usual routine of hoeing, thinning, stirring the earth, and weeding.

Gathering.—If sown early, the leaves of the plants are ready for harvesting in July, which is done as soon as the leaves are full grown, and while they still retain their perfect green color, and succulence. If allowed to remain until they begin to pale, they lose not only in quantity, but also in quality. The leaves are collected in baskets, which are proportioned in number to the extent of the crop. They are picked off by hand, being grasped firmly, and separated from the stem by a sudden twist. In favorable seasons, and on well-managed lands, the plants will often yield two or three crops of leaves; but seldom more than two are gathered, which are sometimes mixed together in the manufacture. The after-croppings, when taken, are carefully kept apart from the others, as their mixture with the first would injure the value of the entire crop. The average product is a ton to a ton and a half of green leaves to the acre. The haulm is either burned for manure, or carried to the barnyard, and added to the compost-heap.

Preparation of the Dye.—The leaves are bruised by machinery, to press out the watery part, afterwards formed into balls and fermented, reground, and fermented in vats, wherein the dye is separated in the same manner as that from the indigo plant.

Saving the Seed.—For this purpose the leaves are allowed to remain on some of the plants during the second year. When it ripens in July or August, it is then treated like turnip-seed.

Uses.—Woad is extensively used in dyeing, as a basis for black, and other colors.

TURMERIC.

Description.—Turmeric (*Sanguinaria Canadensis*,) is a plant peculiar to North America, with a perennial root, fleshy, round, and abruptly terminated, which varies from one-fourth to three-fourths of an inch in diameter, and in length from two to four inches. The external color of the root is brownish, but internally it has a red appearance, and, when cut, discharges an abundance of orange-colored juice. The scape, which is surmounted by a single flower, rises from one end of the root to the height of six or seven inches. It flowers in March or April. The leaf-stalks, which are thicker than the scape, rise from the same part of the root. The leaf-stalks and scape are surrounded at the root by a common sheath. They are of an orange color, deepest near their junction with the root, and becoming paler near the leaves and flowers, where it is blended with green. The seeds, numerous, round, and pointed, are contained in a capsule, which is oblong, swelling in the middle, acute at both ends, and two-valved.

Soil.—This plant inhabits a rich, loose soil, and, though it generally delights in fertile locations, yet it will grow and flourish in sandy, almost arid land.

Uses.—The juice of the root makes a fine orange-colored dye, used for dyeing flannels, woollen cloths, cottons, silk, and linens. The root is used medicinally, both in tincture and in decoction. Under cultivation, the plant is susceptible of great improvement, and may be made a profitable branch of culture as a dye.

SUMACH

Description.—Sumach is a shrubby plant, several varieties of which are indigenous to the United States. It grows from one to three feet high, and the stems, which throw out numerous branches, are covered with a brown bark. The flowers are greenish-white, and the leaves pinnate, with an odd trifoliate leaflet, angularly incised, and pubescent. The fruit is a round drupe, about as large as a pea; and the juice, which is acrid and milky, contains both tannic and gallic acids.

Varieties.—These are very numerous, but the principal are the *Rhus glabrum* and *Rhus coriaria*, powerful astringents, as well as dyes; and the *Rhus cotinus*, or Venice sumach, which is extensively used in dyeing.

Soil.—Sumach will grow on the most rocky and worthless land, and, if managed properly, such tracts will yield a larger return from a crop of sumach than they would under any other vegetable, even with the aid of careful and costly culture.

Climate.—It is a well-known fact that the quality of sumach depends on the heat of the climate in which it is grown, and, consequently, that produced in Virginia excels in quality that grown in Delaware, as much as that of the latter State surpasses the sumach gathered in New York or Massachusetts.

Cultivation.—The European varieties, *R. coriaria* and *R. cotinus*, have as yet only been raised as ornamental shrubs, in the nurseries of the United States. The *R. glabrum* grows spontaneously. No attempt seems to have been made to propagate it from seed, or to introduce into common use the foreign plants, which would doubtless arrive at equal perfection in the Southern States to that attained by them in Spain, Portugal, Sicily, and Syria. In the United States the ordinary practice is to cut over the growth every year, and, by keeping it down, procure an abundance of sprouts of the first quality.

Preparation for market.—The plant must be cut in clear weather, and spread on a floor in such a manner as to allow it to dry rapidly; for, when fermentation begins in a small portion of it, the whole mass soon

becomes seriously impaired. When dry, the plants may be cut up by a straw-cutter, and put into sacks for market, or be ground fine in a bark-mill.

Uses.—*R. glabrum*, *R. coriaria*, and *R. cotinus*, are used in dyeing and calico-printing; the latter variety, especially, producing beautiful golden and orange yellows. The two first-named varieties are used in tanning morocco.

BASTARD SAFFRON.

Description.—This is an annual plant, a native of Asia, known to botanists as the *Carthamus tinctorius*. It has a stiff, ligneous stalk, which

Fig. 96.



grows to the height of two feet and a half or three feet high, and divides upward into numerous branches.

Soil and Climate.—It thrives equally well in a light soil, or in a rich, friable, black earth, and is cultivated in various parts of Europe, especially in the Levant, Spain, and Germany. It is likewise produced in Egypt, and may be readily cultivated in the Southern States of the Union.

Culture.—The seed is sown in rows, or deposited in patches, two feet distant each way; but, after the young plants make their appearance above the ground, they are thinned out, until only two or three remain together in one place. The soil is well stirred, and kept free from weeds, until August, when the flowers begin to expand. The petals of the florets are then cut off, and dried in the shade, or on a kiln. This operation is performed in the early part of each day until October, when the plants are pulled up, sheaved, shocked, and threshed, to obtain the seeds. The stalks are burned, and the ashes used for manure.

Uses.—The petals are used in painting, and also for dyeing silks. A beautiful rouge is made from them. The seeds furnish an oil, which is used by painters and in pharmacy.

TEASEL.

Description.—This plant, a native of Europe, is cultivated with eminent success in Germany, in some parts of England, and in the United States. It is an herbaceous biennial, growing from four to six feet in height, the stem and leaves rough and prickly. The flowers are whitish in color, with very numerous pale purple anthers, in a close, obtuse, conical head, the intermediate scales of which are bristly at the edges, with rigid and hooked points.

Varieties.—There are three varieties: the fuller's teasel (*Dipsacus ful-lorum*), wild teasel (*D. sylvestris*), and small teasel, or shepherd's staff (*D. pilosus*). The first variety is the only one cultivated, the others being of no use whatever.

Soil and Culture.—The soil should be a deep, rich, moist loam, and the cultivation as careful and thorough as for any garden crop. The seed is sown in spring, but the crop does not mature until autumn of the following year; and in order to procure an annual crop, the following plan has been used by some cultivators. The seed is planted in two rows, sixteen inches apart, and a space of twelve inches left between the plants in the row. Then, at a distance of four feet, two more rows are planted, as before, and so on, alternately, over the entire field. The open spaces serve for the crop of the following year, and are manured by means of a hand-cart. Turnip seed are frequently sown on the vacant spaces. Others sow the seed in rows eighteen inches apart, and subsequently thin them to a distance of four inches from each other in the row. The plants should be kept clear of weeds, and carefully tended. The same piece of land, if well cultivated, will bear a good crop for several years in succession, and the quantity of seed sown varies from one to two pecks per acre, according to the method of cultivation. If sown broadcast, as is done in England, the latter quantity will be required; but if the American drill system is adopted, which is far preferable, the former will suffice.

Gathering the Crop.—The ripeness of the teasel is ascertained by its color, which must be of a greenish-yellow. If entirely yellow, it is an indication that it has been cut too late, and the strength is gone. If quite green it is not good, as then the teeth all run one way, and do not come back, not having had sufficient sun. In harvesting the crop, the heads are cut off as they become ripe; though ordinarily the work is

done at three different times, with intervals of ten days between each. The operator, whose hands are covered with a pair of stout gloves, is furnished with a short-bladed knife, having a string attached to the handle, which is passed around his wrist. He seizes the ripe heads, cuts them off with about nine inches of the stem, and ties them up in handfuls, with a perfectly-ripened stem. In the evening they are placed in a dry shed, and subsequently, when the weather is clear, they are exposed to the heat of the sun, until they become perfectly dry. They are then stowed away in a dry room, where they remain until sorted for market, when they are divided into three classes, and done up with great care and neatness. The bur must be one and a half inches long, in order to be marketable.

Saving the Seed.—A few of the finest and best plants are left uncropped, and when the seed is ripe, only the largest and terminating heads are cut off, the seed separated by the aid of a flail, and cleansed with a sieve or winnowing machine.

Use.—To raise the nap on woollen cloths, for which their hooked teeth admirably adapt them. For this purpose they are fixed in parallel rows on the circumference of a broad wheel, against which the cloth is pressed while it is revolving. Many attempts have been made to substitute machinery for the teasel, but without success—all machines having proved inefficient or injurious. The scales of the teasel are just strong enough to raise the wool, giving way before they can injure the cloth. The dressing of a piece of cloth, usually thirty-six yards in length, requires from 1500 to 2000 teasels, as they are repeatedly used in different parts of the process. Those held in highest estimation are raised in Germany, where great pains are taken in their culture. The English, being of an inferior character, command a smaller price; yet they are frequently imported into the United States, as the German teasel. The produce of Connecticut is as fine as any of the imported, and farther south they might be brought to still greater perfection, and yield a very handsome return to the cultivator.

Value of the Crop.—From eighty-five thousand to one hundred and fifty thousand, and in some cases three hundred thousand teasels, have been gathered from one acre of ground. The price ranges from \$1.50 to \$3 per thousand; and at the minimum quotation the profit would be amply sufficient to repay the trouble of their culture.

COLZA.

Description and Use.—But little cultivated, as yet, in the United States, except among the German population of Texas, though of great import-

ance to the farmers of France and Belgium. Colza is a variety of the cabbage family, entirely distinct from rape, and two species of it are cultivated in France. One, a biennial, is sown in summer or autumn of one year, and matures its seed the following summer. The other is sown in the spring, and matures the same year. The first species, the *Brassica campestris* of botanists, is called winter colza; the other, the *Brassica arvensis* of naturalists, is known as spring colza. It is cultivated for its oily seed, from which the oil is extracted by pressure, and used to burn in lamps, as well as for many other useful purposes. The cake remaining after the extraction of the oil, forms an excellent article of food for cattle, and is sometimes used as a manure.

Soil. — To insure good crops, the seed should be sown on rich, light soils, well manured, and carefully worked; though very satisfactory returns have been received from light and gravelly soils. It flourishes in soils of a slightly clayey nature, if they are light in texture.

Sowing the Seed of winter Colza. — This is done in three ways, viz.: broadcast, in rows, and in beds for subsequent transplantation; but very rarely by the latter mode, except where labor is very cheap and abundant. Drill-barrows are used for sowing the seed in rows, which are laid off at a distance of eighteen inches from each other — thus admitting of the use of a cultivator for clearing out the weeds. The period of sowing is generally from the 15th of July to the 15th of August, and about six pounds of seed are used to the acre when sown broadcast, but only about half the quantity when planted in drills; the seeds being dropped about one inch apart in the direction of the rows.

Culture. — If planted in rows, the cultivator is run through them in the month of March, to clean out the weeds, and loosen the soil; after which they require no farther attention until harvest.

Gathering the Crop. — The winter colza matures about the beginning of July, and, as the seeds are apt to shed, it is necessary to cut the plants before they are fully ripe. This is done when the seed-pods begin to turn yellow and become transparent, at which time the seeds, though still tender, are of a dark brown color, and will ripen in the stack or mow. When over-ripe, the plants are cut only in the morning and evening, while the dew is on them. If the crop is a heavy one, the colza, immediately after being bound in sheaves, is stacked in the field where grown, in cone-shaped stacks, so constructed as to exclude rain, where it remains until the grain has fully matured, which is generally in eight or ten days. The fermentation which takes place in the stacks, gives the grain a fine color, and adds to its quality. A small crop is commonly taken at once into the barn, and threshed; but large crops are sometimes trodden out

in the field by the feet of horses, the ground being covered with stout hempen cloth. If the seed is kept in bulk after it is threshed, it should frequently be turned and stirred to prevent it from heating, to which it is subject. As it keeps better when mixed with the chaff, it should only be cleaned when about to be sold or to be pressed.

Extracting the Oil.—This is done by putting the seed in bags, and submitting it to the pressure of a powerful press. The refuse, like that of flaxseed, is called oil-cake.

Spring Colza is very productive in new soils, but, like all oily grains sown in the spring, it is a very uncertain crop. It must be sown during the latter part of May, to insure its arrival at maturity in proper season for harvesting. Sown broadcast, or in drills, on the soils of recently-drained marshes, it is one of the most profitable plants that can be raised on them. Occupying the ground but a short time, it requires but little cultivation.

RAPE.

Description.—The rape (*Brassica napus*,) a native of Great Britain, is a biennial plant of the turnip family, having a caulescent or woody fusiform root, unfit to be eaten by animals. Its leaves are smooth, and, when cultivated, it produces an abundance of them, as well as of seeds. The leaves are edible, and, from the seeds, oil of a very superior quality is expressed, which is extensively used in the arts and for machinery, because it does not produce spontaneous combustion like most other oils. It has never found great favor in this country, but now that sperm and other similar oils have become scarce and expensive it might be remunerative, if the proper attention was paid to its cultivation, and some pains were taken to ascertain what the peculiar nature of its oil more particularly fitted it for. In England it is found to be an excellent article for the fattening of cattle, who are very fond of it. A bushel of the seed will generally yield a gallon of oil, and the cake left after the expression of the oil affords a rich food for cattle. From 50 to 70 bushels is the average per acre.

Soil.—The soils best suited to this plant, and on which it flourishes most, are those of a deep, rich, dry, and kindly nature; but it will thrive on almost any soil, provided it is made sufficiently rich.

Culture.—Being a hardy plant, it requires less culture and manure than the turnip, and may be grown in situations where the latter cannot be produced with profit. It is cultivated in the same manner as the turnip; the preparation of the land, its formation into drills, the manuring, and the sowing of the seed, being the same; but the mode may be

varied in accordance with the time of sowing, the nature of the soil, and the locality. If the seed is sown broadcast, as is the practice with many cultivators, four quarts will be required per acre; but if drilled in, one-half that quantity will be sufficient. The drills may be placed as close together as will admit of the use of a cultivator. If designed as food for sheep or cattle during the autumn and winter, the seeds are sown in June; but if intended to produce and ripen seed the following year, August or September will be early enough. The subsequent culture consists in hoeing, weeding, thinning out the plants, and keeping the soil in good condition.

Gathering the Crop.—The seed ripens in July, and the plant must be harvested with great care to prevent loss from handling, shaking, or carriage, as, when the pods are quite dry, a very slight cause is sufficient to make them part with the seed. Fine weather should be selected for harvesting the crop, which it will be advantageous to thresh out at once, either on the field, or in the barn. If on the field, the ground should be covered with large canvass sheets, to prevent the grain from being tramped into the soil. As the seed is liable to heat, it must not be left on the threshing-floor, but be divided into small parcels, and frequently turned. In ordinary seasons, on rich soils, the produce will average from forty to seventy bushels to the acre; but much depends on the nature and condition of the land, and on the tillage.

Uses.—The oil pressed out of the seed is devoid of smell, when purified, and burns with a brilliant, clear flame. The cake left, after the oil is expressed, furnishes a nourishing and very agreeable food for cattle, which thrive and fatten on it; it forms also a good manure for various crops, particularly root crops, when sown on the drill system. As a green food for cattle, its leaves are unsurpassed by any other vegetable; and the produce, when well manured, is enormously large. Manure makes the stalks so tender and juicy, that, when cut into small pieces, and fed in the green state to cattle, they will consume every particle of it. It is also an excellent preparation for wheat, because, being harvested early, sufficient time is allowed to get the ground in readiness for that grain.

SUNFLOWER.

Description.—The sunflower (*Helianthus annuus*), a native of America, is a tall, majestic plant, having a stout, woody stalk, and bearing a flower, four and sometimes five inches in diameter. The flowers are of a brilliant yellow color, which, together with the popular, but erroneous idea, that they always face the sun, gave origin to the name. Each flower

will furnish about a gill of seed, which yields a most excellent oil. Its value as an oil-plant has been known at least a century; yet, strangely enough, but little care or systematic attention has been devoted to it. It has filled a vacant place in the flower-bed, or in front of a shrubbery, while its more useful qualities have been entirely overlooked.

Soil and Culture.—It will flourish in almost any soil, but for profitable cultivation it requires a good soil, well worked, and thoroughly manured, as well as cleaned. One acre of land will contain 25,000 plants, at a distance of twelve inches from each other. Sow early in the spring, in rows, leaving two feet between the rows. After they have attained the height of three feet, they require but little cultivation, beyond keeping the ground free from weeds. The produce will be according to the nature of the soil and mode of cultivation; but the average has been found to range between fifty and seventy bushels to the acre, which will yield the same number of gallons of oil.

Uses.—The oil is excellent for table use, being equal to olive-oil, for burning in lamps, and for the manufacture of soaps. The cake, left after all the oil has been expressed from the seed, furnishes a good article of food for swine and poultry. On the continent of Europe the stalks are used for pea-sticks, fuel, etc. and the leaves for fodder. Ten per cent. of potassa may be obtained from the stalks when burned; and the green leaves, dried and powdered, make excellent fodder for milch-cows, when mixed with bran. Poultry are very fond of the seeds.

THE CASTOR-OIL PLANT.

Description.—The Palma-Christi (*Ricinus Communis*), or Castor-Oil Plant, grows in various parts of the world, but is indigenous to the

Fig. 97.



West Indies. As grown in the United States, it is an annual, herbaceous plant; yet within the tropics, and in the adjacent warm climates, it

becomes quite a large tree, lasting for several years, having a woody trunk, of the size of a man's body, and growing to the height of fifteen or twenty feet. In the colder climates the stem rises to the height of from three to six feet, is round, in color greenish or reddish brown and blue, and branched. The leaves, which are mounted on long, round petioles, are peltato-palmate, and eight or ten-lobed; the lobes lanceolate and serrated. The capsules are supported on stalks which are somewhat larger than the capsules themselves. They are covered with spines, and are three-celled, each cell containing an oblong, spotted, brownish seed, from which a powerfully-purgative oil is extracted. This property, however, is dissipated under the effects of a high heat.

Varieties. — There are five varieties enumerated, distinguished principally by the color and pruinose condition of the stem — *Ricinus Africanus*, *R. macrophyllus*, *R. leucocarpus*, *R. lividus*, and *R. viridis*.

Soil. — The plant thrives best on a light, sandy loam, although it may be cultivated with success in almost any soil tolerably fertile, or in any climate and situation where Indian corn will thrive.

Culture. — In the cooler parts of the Union it may be planted in hills, distant two feet by three, as early in spring as the warmth of the ground and season will admit. Two seeds should be planted in each place. In the South, where the season is longer, and the plant assumes the character of a tree, the hills should be six or seven feet apart in one direction, and four feet in the other. One seed is sufficient for each hill, covered to the depth of two inches. The only after-culture necessary is to keep the ground well hilled up to the plants, and to eradicate the weeds whenever they make their appearance. As the seeds ripen, the capsules become dry and elastic, and have a tendency to fly off from the plant on the least touch, causing thereby a great loss of seed. To prevent this, while harvesting the crop, the branches should be separated from the plants as soon as the capsules begin to explode, and spread on the floor of a close room. After the beans and shells have separated, the husks may be winnowed in a winnowing machine.

Procuring the Oil. — This is done by two methods — expression and decoction. 1. *Expression.* — The seeds are first slightly heated, and subsequently subjected to powerful pressure under a hydraulic press, when a thick, whitish oil exudes, which is boiled for some time in a large quantity of water, until it dissolves out the mucilage, and coagulates the albumen. The clean oil is then removed, and boiled with a very small quantity of water, to drive off the acrid principle. 2. *Decoction.* — The seeds are bruised first, and then boiled in water until the oil rises to the surface, when it is skimmed off, and again boiled, to remove the acrid

principle. This oil is usually of a darker color than the first. The manufacture of the oil is an extensive branch of business in several parts of the Union.

Uses.—The oil expressed from the seeds is used as a medicine, and is also prepared for illuminating purposes, for the lubrication of machinery, and for the manufacture of soaps. The cake left after the expression of the oil is very advantageously applied to land, as a manure for wheat and other crops.

CHAPTER IV.

THE KITCHEN GARDEN.

VEGETABLES : — ARTICHOKE — ASPARAGUS — BORAGE — BEAN — BEET — BORECOLE — BROCCOLI — CABBAGE — CARDOON — CARROT — CAULIFLOWER — CELERY — CHIVE — CORN — CORN-SALAD — CRESS — CUCUMBER — DANDELION — EGG-PLANT — ENDIVE — GARLIC — HOP — HORSE-RADISH — LEEK — LETTUCE — MOREL — MUSHROOM — MUSTARD — ONION — OKRA — PARSNIP — PEA — PEPPER — PUMPKIN — RADISH — RAPE — RHUBARB — SALSIFY — SCORZONERA — SEA-KALE — SHALLOT — SKIRRET — SPINACH — SQUASH — TOMATO — TURNIP. HERBS, &C. : — ANISE — BALM — BASIL — CARAWAY — CAMOMILE — CORIANDER — CHERVIL — DILL — FENNEL — FOXGLOVE — HOREHOUND — HYSSOP — LAVENDER — LIQUORICE — MARJORAM — MINT — PARSLEY — PENNY-ROYAL — PEPPERMINT — PURSLANE — ROSEMARY — RUE — SAFFRON — SAGE — SAVORY — TANSY — THYME ; — WITH A MONTHLY CALENDAR OF OPERATIONS.

I. VEGETABLES.

ARTICHOKE. — There are only two or three varieties of this plant cultivated, the *Globe* and the *Green*. The heads, in their immature state, and before their blue, thistle-like flowers open, are cut and boiled in salt and water, the edible part being the fleshy substance on the bottom of the scales, which, to be relishable, has to be dipped in a nicely-prepared sauce of butter and spices, though it is frequently eaten as a salad in a raw state.

Culture, &c. — The artichoke is propagated from seed or from offsets. If by the former, sow the seed in rows a foot apart, as soon as the frost is out of the ground. Thin the plants to a foot apart, in the row; and, in the fall of the year, put out the plants in clumps of four, in rows three feet apart, and the rows six feet asunder. They will produce their fruit the next year. When winter approaches, earth the roots up well, and before the frost sets in, cover all well over with litter. Open it at the breaking up of the frost, dig all the ground well between the rows, and level the earth down from the plants. The young ones, or offsets, which grow out from the sides, must be pulled off; and, if a new plantation is wanted, they may be set out, and will bear late the same year.

ARTICHOKE (JERUSALEM). — This is a small sunflower, with nutritious tubers, less in size than potatoes.

Culture, &c.—It is usually propagated by sets from the roots, in April, and grows in any soil which is moist, sandy, and light. It is cultivated like the potato. When raised for its tuber, it is liable to become troublesome, from the germinating power of even the smallest piece left in the soil. It keeps in the ground all winter, or may be preserved under sand. In the Middle States it thrives well. It yields from 150 to 200 bushels of roots, which are eagerly devoured by swine, and, when steamed or boiled, are quite palatable.

ASPARAGUS.—There are two principal varieties, the purple-topped and the green-topped, the first-named being generally preferred.

Culture, &c.—In the making of asparagus-beds, a proper soil is the first thing needed—one not too wet, nor too strong, nor stubborn, but moderately light and pliable, and well manured. The situation should be one exposed to the sun, ranging east and west. The seed may be sown from the middle of February to the middle of April,—usually about the last of March. Plant five or six inches apart, one inch in depth, putting two seeds in each hole, or sow in drills made the same distance asunder. When the weather is dry, water the beds moderately; also destroy all weeds. Towards the end of October, as soon as the stems are wholly withered, cut them down, and spread them over the ground mixed with dung. The next spring, every other plant must be transplanted into a bed, twelve inches apart, if it is intended that they should attain another, or two years' further growth, before being finally planted out; or, they may be planted immediately in the beds for production. Many gardeners judiciously sow the seed in beds where they are to remain for production. The best time for the final removal is the end of March, if the soil be dry and the season forward. The beds for regular production should be three feet wide; the usual practice is to trench the ground two spades deep, and then cover deep with well-rotted manure. Growing asparagus in single rows three feet apart, giving no dung in winter, merely clearing off the stalks and weeds in the fall, and pointing over the surface about two inches deep with a fork, leaving it rough as possible, is a mode highly commended. In the spring, when the surface is quite dry, it is raked down, and about two inches of soil drawn over the crowns from each side of the rows. When the gathering is nearly over, the ground is stirred again, to loosen the tramping made in gathering the crop. The hollow between the little ridges is then filled up with a powerful compost, and the whole is then drenched with liquid manure. This is summer cultivation.

In May, or early in June, the beds are in full production of young shoots, which, when from two to five inches high, are fit for cutting, and as long as the head continues compact and firm. Cut carefully. The seed is usually

ripe in September; collect it; and, when the pulp and husk decay, clean the seed with water, and then dry it.

Forcing. — In forcing asparagus, such plants may be inserted in hot-beds as are five or six years old, and are of sufficient strength to produce vigorous shoots. To plant old shoots for the main forcing crop is, however, erroneous. The first plantation should be made about the first of October, and, if it works well, will begin to produce in the course of four or five weeks, and continue to do so for about three. The hot-bed may be made in the usual way, and topped with six inches of light rich earth, and kept at about 60° in the day time, and never below 50° at night. In planting, a furrow is drawn the whole length of the frame; against one side of it the first row or course is to be placed, the crown upright, and a little earth drawn on to the lower end of the roots; all round on the edge of the bed, some moist earth must be banked close to the outside roots.

The foliage of this vegetable is liable to be destroyed by the larvæ of two beetles, and the only remedy is to pick off and destroy the affected parts.

BORAGE. — Its fresh leaves are boiled for a dinner dish, or are used in salads. It is aromatic, and therefore sometimes used to flavor wine.

Culture, &c. — A very fertile soil is not necessary; a light and dry one is best suited. It is propagated by seed, sown in March or April, in shallow drills, half a foot apart. Transplanting is but little advantageous or necessary.

BEAN. — The best varieties are the *Early Dwarf*, *Early Mazagan*, and the *Early Long-pod*, the *Broad Windsor*, and the *Dutch Long-pod*. The first is early, the second is later, the third is very prolific, the fourth is large and well-flavored, and the fifth best suited for a late crop. The bean comes up in a week, ten days or a fortnight.

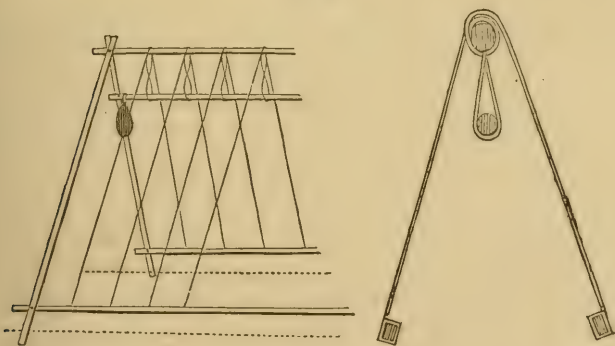
Culture, &c. — The times of sowing, and the situation, for the earliest crops, are the same as for the pea. The seeds may be deposited in drills, an inch and a half or two inches deep, covered and pressed down. It is sometimes customary to plant beans in the same rows with cabbages, and also with potatoes; a bean being planted alternately with every potato-set, or cabbage-plant. All the routine culture consists in destroying the weeds, slightly earthing up the stems, stirring the soil, and watering in very dry weather. A very late crop may be obtained by cutting over a summer crop, a few inches above the ground, as soon as the plants have come into flower. New stems will spring from the shoots in abundance, and continue bearing till frost.

The *Kidney Bean* includes the common dwarf (our bush bean), growing twelve or eighteen inches high, and the runner growing ten or twelve feet. For the dwarf sorts, the first sowing may be made in the beginning

of April, the second about the middle of the month, and after that till along towards August. The rows may be two feet asunder, and the beans deposited in drills from two to three inches apart, and covered to the depth of one to one and a half inches. The routine culture consists in watering in dry weather, where that operation is practicable, and using lime-water, if, which is often the case, the plants are attacked by snails or slugs.

The *twining sorts*, being rather more tender than the dwarfs, are not sown until later in the season. If the soil is in good condition, and the culture thorough, one sowing in May will produce plants which will continue bearing, from the middle of June, till the plants are destroyed by the frosts; but the green pods should be gathered before the seeds formed in them begin to swell. The rows should be in the direction of north and south, should be at least four feet apart, and the beans should be placed in shallow drills, three inches asunder, and covered about two inches with soil. Where the plants come above ground, they may be slightly earthed up, and, in another week, when they begin to form runners, they should be stuck with branches or rods, of six or eight feet in length. In many cases, the scarlet runner may be planted where it will not only produce excellent crops, but afford shelter or shade to a walk, a grassplot or a cucumber-bed. Where sticks or rods are scarce, wires, or even twine, may be substituted, and in this way the scarlet runner may be trained against wooden walls, pales, or other fences, or made to cover walls. The following (Fig. 98)

Fig. 98.



is a good mode of arranging thread or cord for the support of scarlet runners. Take half-inch and two-inch wide laths or rods, join them at the top so as to leave the ends a few inches beyond the junction, and stick the

lower ends into the ground, just within the lines of the plants. Connect these triangles by similar rods at the bottom, about three inches above the soil. Take a cord, fix it firmly to the lower bar, carry it over the upper bar, which is placed in the cross formed by the long ends left, as seen in the figure. Make a loop a yard long, carry the cord again over the plank (that is around it), and fix the other end to the lower rod on the other side. In like manner, go on through the whole length, making the loops all of the same length, and through these suspend a long stick or bar (the section of which is shown at the right hand), and to this bar hang bags of sand, as many as may be wanted. Train the plants up the strings, and when they are well grown, the whole will be covered; and when in flower, the appearance will be very fine. By this method, the cords, being fixed at the lower bars, will not pull the plants out of the earth, the tension and contraction of the cords being counteracted by the bar suspended in the loops, which is raised or lowered by every change of atmospheric moisture. Very abundant crops, however, may be obtained without any resort to staking, by merely stopping the plants after they begin to form pods.

For general cultivation, the *Early Mohawk*, *Early Six-Weeks*, *Early Valentine*, *Yellow Six-Weeks*, *Late Valentine*, and the *Lima*, are highly thought of, and very extensively grown in this country.

BEET. — Among the more common and useful varieties of this vegetable are the *French Sugar*, or *Amber*, *Mangel-Wurtzel*, *Green*, *Yellow Turnip-rooted*, *Early Blood Turnip-rooted*, *Early Dwarf Blood*, *Early White Scarcity*, *Long Blood Red*.

Culture, &c. — Sow beets from the early part of May until June, in drills about three inches apart, thinned to ten or twelve inches in the row. For early use, a small bed of the early turnip-rooted may be sown as soon in the spring as the ground can be fitted for the seed, and these will give good roots in June or July. For fall or winter use, or for general crops, beets should not be sown too early, for such, if suffered to stand, become stringy and fibrous, and not unfrequently shoot up to seed.

A rich, deep soil, is best for the beet, and for all top-rooted plants; and they should, after thinning, be kept free from weeds. They should be gathered before severe frosts occur, and may be pitted or put in cellars for winter use. The thinning of beets must be done while they are young, and the young plants are excellent for greens.

Within a few years the culture of the sugar-beet has received much attention in this country, not only for the purpose of sugar-making, but on account of its being one of the most valuable roots grown for the feeding of animals during the fall, winter, or spring months.

The ground should be prepared by deep ploughing or harrowing, until it

is fine. Open two furrows with the plough two feet apart, and put in a sufficient quantity of manure, according to the state of the ground; cover the dung with the plough by throwing a furrow of earth upon it, ridging as high as can be well done; level the surface of the ridge over the dung, taking care that there is a full proportion of earth over the manure for the seed to vegetate in. Sow with a drill or by the hand, and complete the process by rolling.

To Keep Beets. — To preserve beets during the winter, put them in a dry cellar, with dry sand between them, taking care to expose them a day previous to the air, to carry off the moisture. In quantities, they may be preserved out-of-doors as follows: Take them up three weeks before the hard frost comes, cut off their leaves, let them lie two or three days upon straw or boards; then lay a little straw upon the ground, and, in a fine, dry day, place ten bushels of beets — those that are good — upon it, in a conical form. Put a little straw smoothly over the heap; then cover the whole with six or eight inches of earth, and place a green turf on the top, to prevent the earth from being washed by rain from the point, before the frost sets in. The whole heap will freeze during the winter, but the frost will not injure the beets.

BORECOLE. — The main varieties are *Green Scotch Kale*, *German Curled*, *Purple*, *Jerusalem*, and *Thousand-headed Cabbage*. The last two grow to four feet, and yield large numbers of sprouts.

Culture, &c. — Sow the seed in May; plants are set out in July. They are better when touched slightly by the frost, and may be kept in the same manner as cabbages, during winter. The stocks, in spring, send out numerous tender shoots; and one ounce of seed will produce nearly four thousand plants.

BROCCOLI. — This vegetable is similar to the cauliflower in growth, appearance, and flavor, but it is cultivated more easily, and is more certain to head.

Culture, &c. — The *Early White* and the *White Cape* are considered superior, but the *Purple Cape* is the kind most cultivated. The seeds of the last are sown towards the end of May, in the Middle States, and later for winter supplies. In July, or when the plants are large enough, transplant into very rich, dunged, and mellow earth; plant eighteen to twenty-four inches apart each way, moisten the earth frequently with liquid manure, and hoe and keep clean during their growth. If attacked by the "Black Fly," a solution of brown or soft soap is good to destroy them.

CABBAGE. — This is one of the most ancient and useful of all the cultivated vegetables.

Culture, &c. — The best soil is a strong, rich, substantial one, more

clayey than sandy, though it will grow in any soil, if it be well worked and manured. They are grown either from hot-bed plants, or from seed in the open ground. If the seed of the earlier sorts has been sown in a hot-bed, they will be ready for removal when two or three inches high. In this case, as soon as the season will permit, prepare a bed, by digging out the ground a foot deep, four feet wide, and to as great a length as the extent of your operations will require. Fill this up with dung, cover with earth to the depth of four inches, and set your plants upon it in rows four inches apart, and two inches apart in the row. Water them lightly, and, if convenient, shade them for a day or two, and shelter them at night.

In the open ground, put your seed rows at six inches distance, and put the seeds thin in the row; when up, thin them to three inches in the row, and when two or three inches high, in order to perfect them, they may be taken from the seed-bed, and put into fresh-dug, well-broken ground, at six inches apart, every way. This is called *pricking out*.

Where their distances will allow, it is better to dig between the cabbages once or twice during their growth; and all the larger sorts should, about the time that their heads are beginning to form, be earthed up.

Varieties. — The varieties of cabbage are numerous. The earliest is the *Early Dwarf*, then the *Early Sea Green*, then the *Early York*. The *Sugar Loaf*, a sweet and rich variety, comes in in July and August. For winter use, the *Dwarf Green Savoy* is much esteemed. For *Drum Heads* or other large kinds, sow and transplant same as the *Savoy*. The *Red Cabbage* is treated in the same manner as the *Green Savoy*.

To keep Cabbages. — To preserve cabbages through the winter, lay out a piece of ground four feet wide, and as long as the quantity to be preserved may require; dig on each side of it a small trench, a foot deep, and throw up the earth on the four-feet bed, the top of which should be made level and smooth. Lay some poles or rails at a foot apart lengthwise upon the bed, then put some smaller poles, or stout sticks, across, on the rails or poles, putting these last at five or six inches apart. Upon these lay corn-stalks, or twigs, or brush, not very thickly, but enough so to cover all over. Then, just as the frost is about to set in, take up the cabbages, knock off the dirt from their roots, take off all dead or yellow leaves, and also some of the outside ones, put the cabbage-head downwards upon the bed, with the roots sticking up, and cover them nearly up to the root with straw. Do not pack them so that they will touch each other much; and secure the straw from the operation of the wind. Out of this stack the cabbages may be taken green and good in the spring, when the frost breaks up, and from this stack a supply may be obtained through the whole winter.

Diseases. — The diseases of the cabbage consist of *clubbing of the roots*

which arises from worms, and is produced by growing them too long in one locality; *lice*, which are destroyed by infusion of tobacco, lime-dust, and salt; and *cut-worms* and *slugs*, which should be caught and destroyed before sunrise, — or soot, tobacco, lime, &c., should be worked in about the roots with a trowel.

CARDOON. — This is a species of artichoke, comprising some half a dozen principal varieties.

Culture, &c. — The stalks of the leaves being thick, fleshy, and crisp, are blanched, and used for salads, soups, and for stewing. Sow about the last of April, in deep, light, moderately rich soil, in trenches about six inches deep, twelve wide, and four feet apart, from centre to centre. Drop three or four seeds together, at intervals of eighteen inches, and when they come up, thin them out to single plants. Water frequently in summer, and in a dry day, about the end of October, commence the operation of blanching by tying up the leaves with twisted hay-bands, after which earth may or may not be heaped around them, in the manner of earthing celery, according as they are to be used early or during winter.

CARROT. — There are several varieties of carrot, among which may be enumerated the *Early Orange*, *Early Horn*, and *Altringham*, for the table; and the *Long*, *Lemon-colored*, *Blood-red*, and *Large White*, for larger crops. Other varieties are also highly thought of.

Culture, &c. — The general culture is the same as that of the beet, requiring a deep soil, well manured and worked. The main crops should not be sown earlier than the middle of May, — though some may be sown a month earlier, — as early carrots, like early beets, are apt to throw up seed stalks, which render the vegetable worthless. For extensive culture, the earth may be thrown into ridges two and a half feet apart, manure spread in the furrows, and the ridges split and thrown back upon the manure, and the seed sown on the top of the ridges, after partial leveling. A light rolling is useful, to press the earth about the seed. The carrot will vegetate sooner, and come forward more rapidly, if the seed, previously to sowing, is mixed with sand or sandy loam, and kept moist until it begins to germinate, when it must be sown and at once covered. The plants should be about four or five inches apart in the rows, kept clear, and will be fit to gather late in the fall. They may be preserved by being buried in sand, or in a cellar, but must be kept secure against frost.

CAULIFLOWER. — This is an improved variety of the cabbage, the flowers constituting a compact and delicious mass. The varieties cultivated in this country are the *Early White*, *Late White*, and *Purple*.

Culture, &c. — For spring eating, sow about the middle of September. Prepare the ground by opening small trenches, and dig in some earth in good

compost, to receive the plants. When of a proper size, the plants should be pricked out in a careful manner, and for them the warmest part of the garden should be selected. Being very tender, they should always be put under glass in severe weather. They should not, however, be covered until the weather is severe, and in the mean while the hoe should be frequently used between them, in order to keep the earth dry about their stems. Too much covering weakens them. From their beds they may be planted out in rows, like cabbages, only at rather greater distance, and taking care to move a little earth along with them, about the middle of spring.

CELERY.—Of this vegetable there are the *White*, the *Red*, the *Hollow*, and the *Solid*, the latter being considered the best.

Culture, &c.—Sow about the middle of April, in a rich, moist soil; if not rich, make it so by mixing in fresh vegetable mould, or short, well-rotted manure. Dig deep, and rake it fine and smooth. The seed should be sown liberally all over the surface, and beat the bed evenly and firmly with a clean spade; then sift on a covering of a quarter of an inch of earth, and it will vegetate as soon as cabbage-seed.

In the operations of after-culture, when either the plants left in the seed-bed, or those removed, are from six to twelve inches high, or when the latter have acquired a stocky growth, by four or five weeks' nurture in the intermediate bed, transplant them into trenches for blanching. For this purpose, allot an open compartment. Mark out the trenches a foot wide, and from three to three and a half distant, and dig out the trenches a foot wide, lengthwise, and six or eight inches deep. Lay the earth dug out equally on each side of the trench, put about three inches of rotten dung into the trench, then pare the sides, and dig the dung and parings with an inch or two of the loose mould at the bottom.

Trim the tops and roots of the plants, and then set them in single rows along the middle of each trench, allowing four or five inches distance from plant to plant. Give the plants water, from time to time, and let them be shaded till they strike root and begin to grow. When eight or ten inches high, draw the earth up to them, in dry weather, taking care not to bury the hearts; repeat the earthing once in ten days, till the plants are fit for use.

CHIVE.—This is used as an excellent substitute for young onions in spring salading. A single row, a few yards long, will supply a family.

Culture, &c.—A light, moderately rich soil, is preferable. Plant in May or June, in rows eight or nine inches apart, and four or five in a row. Plant off-sets from the bulbs, keep free from weeds, and in autumn they will appear in large bunches, which may be dug and stored for winter.

CORN.—This useful plant has been fully treated in the preceding chapter.

as one of the heavy or field crops. There are, however, two or three varieties used expressly for the table, which may be appropriately noticed in this place. These varieties are *Adams' Early*, *Sweet* or *Sugar*, and *Early White Flint*.

Culture, &c. — Sow in hills about three and a half feet asunder, from about the last of April to the first of July. The land should be rich, and each hill manured, and only two or three stalks in a hill; the side-shoots or suckers should be removed, and the land should be well dug and hoed.

CORN SALAD. — This is also called *Lambs' Lettuce*, and is raised for winter and spring salads, for which purpose it has long been known.

Culture, &c. — It will flourish in any soil not very heavy, and is propagated by seed sown in the spring, in drills six inches apart, or broadcast and raked in. Should always be eaten when young.

CRESS. — There is the *Garden Cress*, or *Pepper Grass*, the *Indian Cress*, and the *Water Cress*. The first is well known.

Culture, &c. — Garden Cress requires a moist soil, and, if possible, a cool situation. The Indian Cress must be sown in April, in a good strong soil, in rows three inches apart, with sticks upon which the plants may climb. The fruit is full-sized in August, when it is taken green and pickled in vinegar. The Water Cress is a creeping, amphibious plant, cultivated along streams, in rows, about eighteen inches apart. It is prolific, hardy, may be often cut, and is of an agreeable flavor.

CUCUMBER. — The most noticeable sorts are the *Early Short White Prickly*, *Long Early Frame*, *Manchester Prize*, *Kerrison's Long White Spine*, and the *Long Prickly*. The growth of the first-named is four to six inches, sea-green color, forces well; the second-named grows from six to ten inches, is a good bearer and fine variety; the third grows sometimes to a prodigious length, dark-green color, and superior as respects quality and productiveness; the fourth is similar to the third-named; the fifth grows about ten inches, and is a great bearer.

Culture, &c. — For open air raising, cucumbers should be planted in hills about four feet apart, early in May; those intended for pickling may be planted later. Before planting, prepare the ground by mixing well-rotted manure with the earth of each hill. Two or three plants are enough to a hill. The seed should be sown about half an inch deep; the plants must be kept free from weeds, and in very dry weather they should be watered. Some allow the plants to take their own course; others shorten the stem by pinching off the buds; while others bury the runners at short distances, and thus obtain new roots from the buried joints.

To have cucumbers earlier than by the ordinary way, make a hole under a warm fence, and put some hot dung in it. On this put six inches of

fine, rich earth, and sow some seeds in it. Cover at night with a carpet, mat, or other article. When the plants come up, and before they show the rough leaf, plant two in a flower-pot, or small tub, or pail; or let the seeds be originally planted in such as these, or, what perhaps is better, in some large turnips, scooped out and filled with earth for the purpose. The first pots may be put into a bed prepared for them, and covered as before, where they are to stand until cucumbers sown in the natural ground come up, when they may be turned out with the ball of earth and planted. Or, if planted in turnips, put the whole into the ground, and then treat the plants as if originally sown in the open ground. In this way the fruit may be had much earlier than usual.

Forcing.—To force cucumbers, begin ten weeks before the fruit is needed. The Short Prickly, Long Green, and White Spines, are preferred for this purpose. The seeds should be two or three years old, and should be sown in pots placed over a warm bed. Apply tepid water, and take care that no cold air enters the frame. When the second leaves are expanded, transplant into larger pots; place three together. When one month old, carry to the fruiting-bed. The latter is made on a dry spot, with fresh dung, well turned and forked, and four feet high. As soon as the bed is settled, and in regular fermentation, add six inches of fine mould, and if it remains mellow, it will answer; but if fire-fanged, or caked, more will be necessary. The mould should be hilled to within eight inches of the glass frame, and set three plants from the pots in it, transplanting with the ball of earth; these are enough for one frame. Use warm water to them, and darken until they are well rooted. The temperature should be from seventy to eighty degrees,—the steam being allowed to escape as it rises. As the heat lessens, add fresh dung outside, cutting away the old. Form a bank, two feet wide and one foot high, against the back of the frame. Give the plants air and water in the morning. As the roots enlarge, add fresh, good mould.

Enemies.—The striped bug eats the young foliage; the flea-beetle, a small, black insect, destroys the small plants, as also does the squash-bug, a large insect, with brown upper wings and orange belly; the black worm cuts down the young plants, and can only be caught in the morning, as it retires into the earth during the heat of the day. Several species of aphids annoy the plants. The large insects must be caught in nets or with the hand; soot, tobacco-water, solution of whale-oil soap, infusion of worm-wood, Mayweed, pennyroyal, and slacked lime, are all used with advantage. Some allow hens to run among the vines.

DANDELION.—This is a hardy plant, growing spontaneously in this and other countries, and much used as a wholesome table-green.

Culture, &c.—It may be propagated either by seeds or roots, in a moderately well-prepared soil. The flowers may be cut off as fast as they appear, to prevent the dispersion of the seed and weakening the plant.

EGG PLANT.—There are two varieties of this plant, the white-fruited and the purple, the latter kind being preferable.

Culture, &c.—It may be raised by sowing the seed on a slight hot-bed, the beginning of April, or in March; and towards the latter part of May they should be planted in a rich, warm piece of ground, at the distance of two and a half feet asunder, every way, for the purple, or two feet for the white kind; and if kept clean, and a little earth be drawn up to their stems, when about a foot high, they will produce plenty of fruit. Or, the seed may be sown about the end of April, on a warm border, and planted out finally the beginning of June.

ENDIVE.—This is a salad plant, of which there are two sorts, the *Curled* and the *Plain*, the last being the best for use. It is the same as *Chicory*.

Culture, &c.—The soil most favorable to the endive is a light, fresh, moist loam. It is sown in drills a foot apart; when the plants come up, they must be thinned to a foot apart in the row. Hoe the ground frequently, and keep it clean between the plants. Before using as a salad, it must be bleached, by carefully gathering the leaves with the hands into a conical form, and tying them with matting or soft string. This must be done in dry weather, when the plants are of good size, and they will be fit for use after they have remained in the tied state about a fortnight, and will keep till spring. The time of sowing for the spring is as soon as the weather will permit; for the winter, about the last of July or first of August.

GARLIC.—This vegetable has been in use for a long time. It has a very pungent odor. The varieties cultivated are the *large* and the *small*.

Culture, &c.—It is grown by planting the small bulbs, or root, in drills two inches deep, six inches apart, and four inches from plant to plant, early in the spring, on light, rich ground. It should be well hoed. The bulbs attain their full size about the first of August, when the leaves wilt.

HOP.—Perhaps our account of this plant should have been included in the preceding chapter. Under all the circumstances, however, we concluded to give it its present place, believing such an arrangement the best one, on the whole.

The hop is a perennial-rooted plant, with an annual twining stem. The female blossom is the part used, and the female plant is the only one cultivated. The male (*a*) plant and the female (*b*) are both represented in Fig. 99.

Culture, &c.—The soils most favorable are clays, and strong, deep loams,

with a dry and friable subsoil. In preparing it, the weeds should be wholly destroyed, and the ground well pulverized. The ridges should also be made

Fig. 99.



level, and dung liberally applied. The most effectual preparation is trenching, either by the plough or by manual labor. The mode of planting is generally in rows, making the hills six feet distant from each other, this distance giving a free circulation of air, and admitting the sun's rays unobstructed. The planting season is in February or March; but if bedded plants, or such as have been nursed for one summer in a garden, are used, then, by planting in autumn, some produce may be had in the succeeding year. When root sets are used, as on the occasion of grubbing up an old plantation, October is the right time. The plants or cuttings are procured from the old stools, and each should have two joints or eyes; from the one which is placed in the ground springs the root, and from the other the stock or bind. They should be made from the most healthy and strong binds, each being cut to the length of five or six inches. Those to be nursed are planted in rows a foot apart, and six inches asunder, in a garden, and the others at once where they are to remain.

After-culture. — The after-culture of hops, besides the usual processes of hoeing, weeding, stirring, and manuring, includes earthing up, staking, and winter dressing. *Hoeing* may be performed with a horse implement; *stirring*, though usually done with a three-pronged fork, may be done with a plough; *manuring* is either with well-rotted stable dung, or compost, either in spring or fall. Some spread the manure between the rows, others lay it on the hills. It would seem, however, that the best time was the spring, and then it should be turned under by the plough. *Earthing up* is performed the first May after planting, whether that operation be performed

in spring or autumn. In *dressing* the hop plants, the operations of the first year are confined to twisting and removing the haulm, to which some add earthing up in autumn. The yearly operation of staking or setting the poles commences towards the end of April, or at whatever period, earlier or later, the shoots may have risen two or three inches. Two or three stakes are usually put to a hill. *Tying the shoots or vines to the poles* is the last operation in the after or summer culture.

Taking the Crop.—Taking the crop is a most important operation. The time for *picking* varies; light soils and dry situations are earliest; even in a yard of a few acres, situated on a side-hill, the highest ground is often ready for picking some days before the lower; and sometimes, from the poverty of the land, the middle, or, it may be, the lower part, is ripe first. In commencing picking, too much care cannot be taken in gathering those first that are *ripe*, and not picking those that are *largest*, as is often the case. The time of picking may be known by their change of color, from a deep-green to a light-yellow tinge. If they have seeds, the hop ought to be gathered as soon as the seed turns brown; but the certain indication of picking-time, to those who are familiar with the plant, is when the *lupulin*, or small globules of the bright yellow resin, are completely formed in the head of the hop, at the bottom of the leaves, and the leaves are readily rubbed from the stem. The lupulin, or flowers of the hop, as it is commonly called, is the only valuable part, and if gathered too early, before it becomes perfect turpentine, it soon dissipates and loses its fine aromatic flavor, and all its medicinal qualities. Hence, gathering hops too soon is a total loss, and instead of imparting a palatable, pleasant flavor, and giving its fine tonic balsam to ale, they are unquestionably an injury, and ought not to be used; and if gathered too late, the lupulin drops out, and the hop is of no value; but the experienced cultivator takes the medium, — commences when the hop is first ripe, has everything prepared — his hands, kilns, baskets, bagging, &c. Five or six days ought to finish the process of picking and curing, if his yards ripen about the same time. The hop should be picked clean, without leaves or stems, and, if possible, without dew on them; nor pressed too close, nor put in too large quantities, before going on the kiln, or they will heat.

Drying. — With regard to drying, no rule can be given for the thickness they ought to be spread on the kiln, or even for the length of time necessary to dry them. A skilful operator is the only safety in this process. Care ought to be taken that the kiln draws well, as much depends on its draft; the steam should not be allowed to fall back on the hops, and must pass off freely. Preparatory to putting the hops on the kiln, it must have a fire put in, made perfectly dry, and fumigated by burning brimstone, to take away

all the bad smell ; and when perfectly sweet, a layer of hops put on, say eight or ten inches deep, and this may be increased or lessened as the operator finds the draft. The time used in drying will also depend on the quantity of hops on the kiln, and on the draft, — say from eight to sixteen hours ; but they must not be removed from the kiln until the core or stem is crisp and well dried ; they must then be put upon a floor, and occasionally turned, until the leaf becomes tough, when they are ready for bagging. The fuel used for drying must be of the sweetest kind, and perfectly charred ; and the best is beech, birch, hickory, or maple. Pine may not be used under any circumstances, nor any brimstone, only as before directed. When the fire is once put into a kiln of hops, it must never be permitted to slacken or go out, until they are dried. The fire should never be so hot as to burn, or leave the least taint of fire on them.

Assorting. — Hops should be carefully divided into three equal parts or parcels, — the first, second, and last pickings. If six days are consumed in picking, let the hops of the first two days, the third and fourth days, and the last two days, be kept separate, bagged and marked ; each parcel will, by this method, be more valuable to the brewers, and enhance the price of those that should thus be brought to market, if skilfully picked and cured.

The scorching or burning the hops on the kiln is a serious injury, and should be carefully guarded against during the process of drying.

HORSE-RADISH. — This plant is cultivated for its roots principally.

Culture, &c. — It thrives on any soil tolerably good, but prefers a deep, mouldy, rich and moist soil. If manure be necessary, vegetable substances are the best for that purpose. It is propagated from seed and sets, the latter obtained by cutting the main root and offsets into lengths of two inches ; the tops or crowns of the roots form the best, those taken from the centre never becoming so soon fit for use, or of so fine a growth. Each set should have at least two eyes, for without one they refuse to vegetate. The best time for planting is in October, for dry soils, and in February, for moist ones. The sets must be inserted in rows eighteen inches apart each way. The ground should be trenched between two and three feet deep, the cuttings being placed along the bottom of the trench, and the mould turned from the next one over them, or inserted to a similar depth. The shoots make their appearance in May or June. The only culture required is to hoe and rake the ground, and destroy the weeds. In taking up the roots, it should be done regularly, instead of a root here and there, as is often practised.

LEEK. — This is a vegetable which, for certain purposes, is used as a

substitute for the onion. The variety most esteemed is the *London Tall*, or *Musselburg Flag*.

Culture, &c. — The culture of the leek is similar to that of the onion, only it requires more water. Put the rows eight inches asunder, and thin the plants to three inches apart in the row. Hoe frequently between the plants until the middle of July, then take them up, and cut their roots off to an inch long. Make trenches for them like those of celery, only not more than half as deep, and half as wide apart. Manure the trenches with rotten dung, or other rich manure. Put in the plants as you do celery plants, and about five inches asunder. As they grow, earth them up by degrees, as you do celery; and at last you will have leeks eighteen inches long, under ground, and as thick as your wrist. Three leeks planted out for seed will ripen in August, and be enough for the next year.

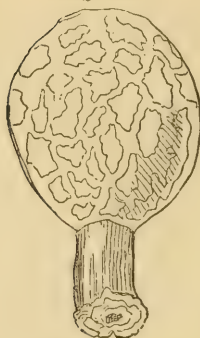
LETTUCE. — This is a hardy annual plant, comprising many varieties, of which the following are among the best: *Brown Dutch*, *Large Indian*, *White Silesia*, *Green Hammersmith*, *Early Cabbage* or *White Butter*, *Royal Cape*, *Grand Admiral*, *Magnum Bonum Cos*, *Brighton Cos*, *Ice Cos*, *White Cos*, and *Green Cos*. The cabbage lettuces are round-leaved, growing in a compact, full head, of squat form, close to the ground. All the *Cos* lettuces, in their general growth, are more or less upright, of an oblong shape. Both kinds have white, close, firm heads, when in perfection; the varieties reach maturity from June till September.

Culture, &c. — All sorts grow freely on any rich, mellow soil, where the subsoil is dry. Raise it on beds set apart for it, keeping the varieties separate; but, to multiply the supplies throughout summer, portions may be sown, thinly intermixed with principal crops of leeks, onions, carrots, and spinach, which will come off before the lettuces are fully grown. Sow from February to July, for the main summer or autumn crops. For an early crop, sow in the beginning of February, on a gentle hot-bed; and when the plants are one or two inches high, in March or April, prick a portion either into a warm border, or else let them be shielded with mats, during nights and bad weather, transplanting to a slender hot-bed, to bring them more forward. According to their progress in April or May, transplant them into the open garden, from six to twelve inches asunder, to remain for heading.

MOREL. — This is a species of mushroom much esteemed in Europe.

Culture, &c. — It is seldom that morel undergoes a regular process of garden culture, though this may be done by collecting the spawn in June, and planting in dung-beds or ridges. It grows on wet banks, in the woods, and in moist pastures, and should be gathered when dry. Used to flavor gravies, &c.

Fig. 100.



MUSHROOM.—This plant grows spontaneously and very luxuriantly, and numbers several varieties, some of which, however, are very poisonous.

Fig. 101.



Culture.—It is now largely cultivated in this country. It needs great care to raise it artificially, and to do so successfully requires a special training. It is raised in hot beds and otherwise. None but those familiar with the different species should collect the article at all, on account of the great resemblance between the good and the poisonous kinds. The crown or hat is at first hemispherical, then convex, and at last flat, fleshy; about two to five inches broad; white, or very light brown, slightly scaly, the scales soft and fibrous; gills pink, changing to brownish black; the flesh, when divided, changes generally to a reddish hue.

MUSTARD.—There are two species of this plant in cultivation, the *Black* (a) and the *White* (b). They are annuals.

Culture, &c.—In cultivating white mustard, for spring and summer consumption, sow once a week or fortnight, in dry, warm situations, in February and March, and, afterwards, in any other compartment. In sum-

mer, sow in shady borders, if it be hot, sunny weather. Generally, sow in shallow, flat drills, from three to six inches apart; scatter the seed thick

Fig. 102.



and regular, and cover in thinly with the earth, about a quarter of an inch. To furnish gatherings in winter or early in spring, sow in frames or under hand-glasses, and when the weather is frosty, or very cold, in hot-beds. This species is cultivated chiefly as a small salad, and is used like cresses, while in the seed; when these are newly expanded, they are mild and tender, but when advanced into the rough leaves, they eat rank and disagreeable. In many parts, the seed of the white species is preferred for mustard, giving a whiter and milder flour than the black. It is also used medicinally, cleansing the stomach and bowels, and bracing the system at the same time.

The black mustard is chiefly cultivated in fields for the mill. It must be sown in April, in drills, from six to twelve inches asunder, or broadcast, and rake or harrow in the seed. When the plants are two or three inches in the growth, hoe and thin them moderately where too thick, and clear them from weeds. They will soon run up in stalks, and in August return a crop of seed ripe for gathering.

ONION.—The best varieties are the *New England White*, *Large Red*, *Yellow* or *Silver-skinned*, *Yellow Dutch*, *Strasburgh* or *Flanders*, and *Madeira*, the *Yellow* or *Silver-skinned* and *Large Red* being the best for a general crop, and the *New England White* for the table and pickling.

Culture, &c.—For a general crop, the ground should be well prepared by digging in some of the oldest and strongest manure that can be got. Plant in April or May, sowing the seed moderately thick, in drills one inch

deep and twelve inches apart. When the plants are up strong, they should be hoed, and three times during the early part of their growth. Those beds that are to stand for ripening should be thinned out, while young, to two or three inches apart. When the greenness is gone out of the tops of onions, it is time to take them up, for from this time the fibrous roots decay. After being pulled, they should be dried, and then removed to a place of shelter.

The small onions may be planted in the following spring. Even an onion which is partly rotten will produce good bulbs, if the seed-stems be taken off as soon as they appear. Most of the varieties are propagated by seed. The potato onion, however, does not produce seeds, but increases by the root. One onion, slightly covered, will produce six or seven in a clump, partly under ground. The bulbs are generally planted in the spring, twelve to eighteen inches apart, though they are apt to yield better when planted in autumn, as they will survive the cold, if covered with dung, litter, &c.

OKRA. — This plant is not much in general use in this country. There are two varieties, the large and the small podded or capsuled.

Culture, &c. — It may be sown, with certainty of success, at the time of planting Indian corn. Draw drills about an inch deep, and four feet asunder, into which drop the seeds at the distance of eight inches from one another, or rather drop two or three in each place, lest one should not grow, and cover them an inch deep. As they advance in growth, earth them up like peas, and they will bear well.

PARSNIP. — The choice sorts of this vegetable are the *Guernsey* or *Common*, and the *Sugar* or *Hollow-Crowned*, the latter being the best garden variety.

Culture, &c. — Like the carrot and beet, the parsnip requires a light, rich, dry soil, and the sooner the ground is prepared in the spring, and the seed put in, the better the roots will be, as a long season is necessary to their perfection. Sow the seed in drills, the same as carrots, and left, in thinning, eight inches apart in the rows. They must be kept clean by frequent hoeings, and in the autumn are fit for use; but as they improve in quality by being exposed to the frost, and will remain in the earth without injury, those intended for spring use are left in their beds, and are usually found in a fine state in the spring months. The seed of this plant vegetates with some difficulty, and in a light, dry soil, should have the earth pressed upon them with a roller immediately after sowing.

PEA. — The varieties of this useful and nutritious plant most commonly cultivated for market and garden use are the following: *Extra Early*, *Early May*, *Early Frame*, *Early Charlton*, *Bishop's Early Dwarf*, *Blue Marrow*, *Woodford Marrow*, *Sugar Pea*, *Knight's Dwarf Marrow*, *New Mammoth*, *Early Washington*, *Early Double Blossom*, and *Early Warwick*.

Culture, &c.—Sow as early in the year as the ground can be worked, in double rows, four feet apart, covering about three inches. Manure

Fig. 103.



moderately, and dig it in well. As the early crops appear, draw the soil over them; and as they advance from half an inch to three inches high, and when the weather is dry, draw the earth to the stems, and continue to hoe and earth up, as it will assist the peas to bear plentifully. When they are six or eight inches high, place a row of sticks or brush, about five feet long, in the middle of the double rows, and a few smaller ones on the outside of each row. Sow again from the middle to the end of April, for use in July and August.

The crop is readily collected by a short scythe and horse-rake, or by hand. It should be done while the haulm is of a yellowish green, or the peas scatter. The haulm in this state is a very valuable rough fodder, if carefully housed. The grain is threshed out, and forms excellent provender for stock and poultry.

Enemies.—The pea is subject to but few diseases. The pea-bug punctures the pod when very young, and deposits an egg. Very few crops entirely escape them, except such as are sowed about the middle of June. It is therefore best to sow a part about that time, for seed, or to keep a sufficient quantity over one year.

PEPPER.—The varieties grown for pickling and kitchen use are the *Sweet or Bell*, the *Cayenne*, and the *Tomato or Flat*.

Culture, &c.—Sow a small portion of seed, thinly, half an inch deep, on a hot-bed or in a pot, in April, and transplant in June, on good soil, twelve inches apart, and eighteen inches from row to row. As they grow, hoe

frequently, earthing up the stems. When sown in the open ground, the time is the same; let the soil be light and warm, and transplant when three to four inches high.

PUMPKIN. — The best varieties of pumpkin are the *Cashaw*, *Family*, *Connecticut Field*, *White Bell* and *Valparaiso*.

Culture, &c. — The best time for sowing is about the middle of May. It will grow in any dry and well-worked soil. It has been usual with farmers to grow their pumpkins in the corn-field; but whether this is a good practice or not, is somewhat doubtful. A good crop of pumpkins must necessarily take from the sustenance which would otherwise go to nourish the corn. When planted with Indian corn, they may be put between the hill of corn of every fourth row and every fourth hill, upon a shovel full of rich manure, two seeds in a hill. When the plant is grown by itself, let the hills be eight or nine feet apart; two or three plants in a hill are sufficient, though it will be more advisable to put in more seed, to provide against accidents, and the surplus plants can be withdrawn. To preserve the crop pure, the seed should not be taken from plants growing near squashes.

RADISH. — There are two species, the long and the round; and of these there are several varieties, which are named below.

Culture, &c. — For the early crops, use the *Long Scarlet Short Top*; the *Long Salmon*, similar to the preceding, but of lighter color; the *Scarlet Turnip Rooted*, and *White Turnip Rooted*. Frequent sowings are necessary, as the foregoing soon become pithy and shoot to seed; in flavor they differ but little. At the same time the early kinds are sown, make a sowing of the *Yellow Turnip* and *Summer White*, which are fine kinds, withstand the heat, and are firm and crisp even in hot weather; frequent sowings of these, as well as the *White Spanish*, or *Black Spanish*, as most liked, should be made during the summer months. The two latter kinds, sown in autumn, keep well in winter, if secured from frost.

Forcing. — In forcing radishes, a moderate hot-bed is necessary, the earth about eight inches deep, on the surface of which the seed is to be sown as soon as the violent heat has abated, and an additional half-inch sifted over it. Keep the temperature at about sixty-five degrees, admit the air except in the evening, and, when the earth is dry, give a light watering. The seedlings are generally up in a week, and in six weeks may be drawn.

RHUBARB. — The principal varieties are *Buck's New Scarlet*, of a deep red; *Tobolsk*, very early; *Goliah* and *Admiral*, large size; *Elfort*, *Wilmot's Early Red*, *Myatt's Victoria*, and *Australian*.

Culture, &c. — The seeds should be sown in April, in a border, and scattered thinly in drills, two inches deep, and a foot asunder, slightly

covered with soil When the plants appear, they should be thinned out to about six inches from each other, and afterwards to a foot. A light, dry soil, is excellent.

Fig. 104.



As soon as the leaves are decayed, the seedling plants should be taken up with care, and planted out in rows, two feet apart, and the same distance between the plants. A shady spot is preferable, as the stems will be finer and better when not too much exposed to the sun. Give an annual top-dressing of well-rotted manure.

A simple method of forwarding rhubarb is by turning over the plants, as they stand in the open ground, empty barrels or boxes, which may be surrounded by coarse litter or stable manure.

RAPE (*edible-rooted*,) is a white, carrot-shaped root, about the size of a man's finger, having a more delicate flavor than the turnip, like which it is cooked. It is not peeled, but scraped—the skin being remarkably thin.

Culture, &c. — It is propagated by seed, which may be sown in April and June. It will grow in any soil that is poor and light, more especially if it be sandy. It grows to a larger size in rich, manured earth, but deteriorates in sweetness and flavor. The same mode of cultivation and treatment applied to the turnip will answer for this root; but in dry weather the beds must be regularly watered until the plants have developed their leaves.

SALSIFY. — This plant is also called *Vegetable Oyster*; its flavor, when properly cooked, being very similar to that of the oyster.

Culture, &c. — Deep and humid soils are the most favorable. After digging and smoothing, the plot intended for it should be formed into four-

feet beds, and the seeds be sown and covered in rows, eight or ten inches apart. This should be done as soon as the frosts are over in the spring, for the earlier the sowing, the finer will be the crop. Two hoeings, and frequent watering when the weather is very dry and hot, are necessary. The plants attain their full size in autumn.

SCORZONERA. — A plant mostly grown in Europe, for its roots, to use in soups, &c.

Culture, &c. — It is raised very much as is salsify. If the seeds be sown in April, in a good deep soil, the roots will attain perfection in autumn, and continue good through winter. They last three or four years, but it is better to raise a few from seed every year.

SEA-KALE. — It grows wild in Great Britain, but is extensively raised in gardens.

Culture, &c. — It will succeed well in any dry and deep soil. A bed may be composed for it of one half drift sand, one third rich loam, and one third small gravel, road-stuff, or coal-ashes. If the soil be wet, drain it; and if poor, manure it well. Propagate by seed; and if the weather in June and July be very hot, water plentifully. It flowers about June, and the seed ripens in August. The signal for cutting is when the plants are three inches above the surface.

SHALLOT. — A plant often used as a substitute for the onion, having a stronger taste, but not leaving so strong an odor as that plant.

Culture, &c. — Each offset of the root will increase, if planted in a similar manner to its parent. The planting may be performed in October or November, or in the spring — March or April. The first is the best season, if the soil lies dry, as the bulbs become finer; but otherwise, the spring is preferable, for excessive moisture destroys the sets. Plant six inches asunder each way, in beds four feet wide, in drills.

SKIRRET. — The root is composed of fleshy tubers, joined together at the crown or head, and used in cookery.

Culture, &c. — It grows freely in a light, moderately good soil. It is propagated both from seed and offsets of established roots. The former mode is preferred. Sow about the middle or last of April, in small drills, eight inches apart. When the plants are one or two inches high, thin them to five or six inches asunder. They will continue to grow until the end of autumn, and may be used all along. Those left to reach maturity will be good for winter use, also for spring, till the stems run. When grown by offsets, take only the young outward slips.

SPINACH. — There are two varieties, the *Round-leaved* or *Smooth-seeded*, and the *Prickly-seeded*. The *New Zealand* is also a species highly regarded.

Culture, &c. — The Smooth-seeded is better for spring and summer use, and the latter for autumn sowing. Sow broadcast or in drills; when drilled, it is easier kept clean, and more readily gathered for use. The drills should be twelve inches apart, the plants four inches apart in the rows. If sown thicker, thin out, when young, as wanted, leaving plants at proper distances. For spring and early summer use, sow early in spring, and occasionally afterward; for the early autumn supply, sow at close of summer, and for the main winter crops, about middle of autumn. Before very cold weather give a light covering of straw, cedar-brush, or anything that will lay lightly and partially protect it; otherwise, the frost will injure.

SQUASH. — The kinds most suitable for cultivation are the *Early Bush*, *Vegetable Marrow*, *Lima*, *Cocoa-nut* or *Acorn*, and *Green Striped*.

Culture, &c. — Dig deeply patches of earth, at the distance of four or five feet each way, mixing in well-decomposed manure, in liberal quantities. In each patch or mound of earth plant about half a dozen seeds, and when the plants are well grown, remove all but two or three of the best. Sow about the middle of April; or, for early crop, start them in pots or hot-beds.

TOMATO. — The kinds most usually grown are the *Large Smooth Red*, *Large Red*, and *Cherry-shaped*. The yellow tomato is not much raised.

Culture, &c. — The best soil is one that is light, rich, with a dry sub-soil. Sow the seed in April, scattering it thin, and not burying more than half an inch below the surface. The plants soon appear, and when of two or three weeks' growth, they must be thinned to three inches apart, and those removed, if wanted, pricked at the same distances, in a similar bed to that from which they may be removed. On the approach of frost, pull up some of the plants, root and all, which are well laden with fruit, and hang them up in a dry, airy apartment. In this manner it may be continued in perfection after the natural season.

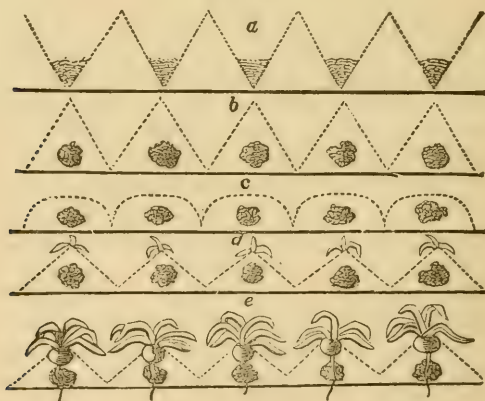
It is recommended to cover the earth around each clump with straw or litter, which prevents rapid evaporation in hot weather, and protects from heavy rains. Some brush-wood stuck around the plants, to support them, is also useful.

TURNIP. — The principal sorts are the *Early Yellow Dutch*, *Early Red top Dutch*, *White Norfolk Globe*, *Yellow Aberdeen*, and *Early White Dutch* together with the valuable *Ruta-baga*, or *Swedish Turnip*.

Culture, &c. — The soil should be thoroughly ploughed, harrowed, and rolled; the weeds should be well raked up, and everything done to bring it into a state of good tilth. As drilling or sowing the seed in rows is most generally practised, the soil should be thrown into ridges by a plough, the ridges having a sharp top, and being at the distance of from twenty to thirty inches from top to top. After the ridges are formed, the manure is hauled

on the ground, thrown out at convenient intervals, and immediately placed in the furrows. A section with the manure deposited in the furrows is shown in Fig. 105 *a*. As fast as the manure is distributed in the furrows, it should be covered, which is effected by splitting the ridges with either a double or a single mould-board plough, forming a new ridge on which the seed is to be sown, directly over the manure. A section of the new ridges is represented (*b*). The rolling and seed-sowing (*c*) succeeds this operation; then the young plants, with the earth hoed away from them (*d*), are seen; after this, the plants further advanced, covering the soil with their leaves, and enjoying the dung with their roots, (*e*); and, finally, the plants full-grown.

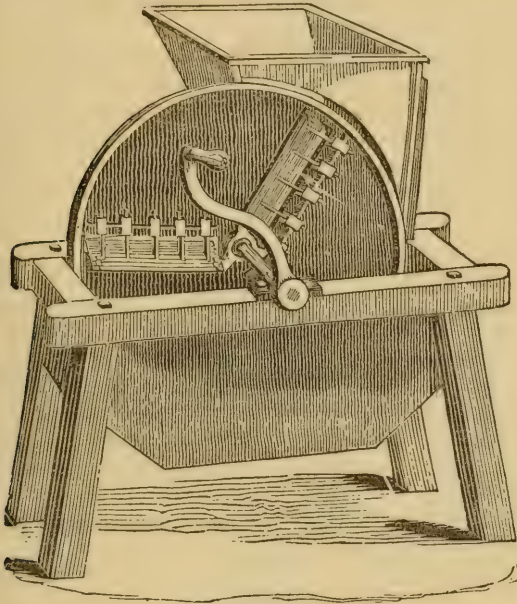
Fig. 105.



The Swedish turnip, or ruta-baga, has a decided advantage over all other varieties of turnip as cattle food, being the most nutritive, and retaining its soundness and richness much the longest. When given to cattle, it should be cut, by means of the vegetable cutter. A grass lea is best for this variety. If an old sod, plough it in autumn or early in spring, and manure and completely pulverize before planting. If a young clover lea, the manure may be spread, ploughed under, the ground harrowed, and the seed immediately put in. Sow at the rate of one to two pounds the acre. In the after-culture, the objects aimed at are to keep the crop clean, to thin the plants to eight or ten inches, and to keep the surface of the soil mellow. The turnip should be the last crop gathered, because it grows the longest, is least liable to suffer from frost, and is liable to be injured by fermenting, when collected in heaps for winter. If buried in pits, the roots should be raised above the surface of the ground, and laid up to terminate in a ridge,

so that when they are covered with straw and earth, the heated or impure air of the pit will concentrate at the ridge on the top, where it should be suffered to pass off freely through holes made for the purpose.

Fig. 106.



Enemies. — The turnip-flea is a great scourge. To avoid it, it is recommended, first, that the germination of the seed be hastened by all natural means, as applying some portion of stimulating manure, sowing when a proper degree of moisture exists, and in close connection with the manure, to secure at once the benefit of it to the roots, if possible, making most of the season, when favorable. Second. That a liberal quantity of seed be sown, in drills, which will hasten the vegetation after it has come up. Third. That the land be well cleared, the weeds wholly eradicated, and the soil well supplied with manure suited to its character. Fourth. Select good seed, and test it before sowing, to see how many germinate, and how soon.

Uses. — The root is an excellent food for every species of farm-stock, and is very extensively used for fattening beef, mutton, and pork. When milch cows are fed with ruta-baga, it should have a little salt sprinkled upon it.

II. HERBS, &c.

ANISE. — This is a half-hardy annual, used for garnishing or seasoning and much esteemed for that purpose.

Culture, &c. — Sow during April, in pots buried in a hot-bed; remove to a warm, light border, in May; thin the plants to six inches apart. The seed is ripe in August and September.

BALM. — The balm is a hardy plant, with square stems, rising two feet high or more, with large leaves growing by pairs at each joint.

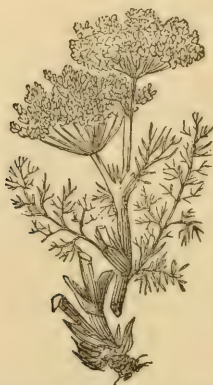
Culture, &c. — It is propagated by parting the roots, preserving two or three buds to each piece, or by slips, either in autumn or spring. Plant in any bed of common earth, from eight inches to a foot apart, watering, if the weather be dry. Gather when the plant is coming into flower; and when the leaves are entirely free from moisture, dry them, and, when cool, press into packages.

BASIL. — The *Sweet-scented* and the *Dwarf Bush* are the two varieties.

Culture, &c. — A rich, light soil is the best. Sow the seed, in a gentle hot-bed, early in April; to be thinned, and those removed pricked out at the close of this latter month in a similar situation, to be finally removed in the course of May or June, when the weather is settled, in open ground. When thinned, the seedlings must be kept at three inches apart, and those removed pricked out at a similar distance. Water at every removal, and, during the growth, hoe, and keep clear from weeds. Gather seed from the earliest raised plants.

CARAWAY. — A biennial plant, with a taper root, stems rising from a foot

Fig. 107.



and a half to two feet, spreading branches, and finely-cut deep-green leaves.

Culture, &c. — A clayey loam is the best soil, which should be well ploughed; sow in March, directly after the plough, harrowing well. In ten weeks after, hoe, and repeat hoeing two or three times before cutting, which may be done in July; after which, thresh it upon a cloth.

CORIANDER. — A small-rooted annual, with branchy stems.

Fig. 108.



Culture, &c. — Sow on a light, rich soil, in the fall, with fresh seeds twenty pounds to an acre. Thin the plants to six or eight inches apart every way, and in the spring stir the soil with a hoe. The seed ripens in August, when it must be carefully cut and gathered. A few strokes of the flail will get the seeds out clean.

CAMOMILE. — This is a well-known creeping plant, cultivated for its flowers.

Culture, &c. — The double-flowered variety is the most commonly grown, but the single possesses more of the virtue of the plant, according to its weight. It only requires a poor soil, planted in rows a foot apart, and hoed between. It will produce abundance of flowers annually, from June to September.

CHERVIL. — The *Parsley-leaved* and *Fern-leaved* are raised by the Europeans, but in this country the plant is not much attended to.

Culture, &c. — Sow the seed in early autumn, as soon as it is ripe; sow in drills eight inches apart, or broadcast; thin the plants to eight inches asunder, and keep free from weeds.

DILL. — It is cultivated for its leaves and blossoms, which are used for pickling, and in soups and sauces.

Culture, &c. — Soil rather dry; sow as soon as the seed ripens, in drills a foot apart; thin to about ten inches asunder, after three or four weeks' growth; keep clear of weeds; and, for seed, cut in September.

FENNEL. — Resembles the dill, but is larger; grown for its stalks and leaves.

Culture, &c. — Three or four plants are sufficient for any garden. The variety called the *Finocchio* may be grown in rows, on light, rich soil, and earthed up to the height of five or six inches, which blanches the stalks in ten days or a fortnight. Water in very dry weather.

FONGLOVE. — A medicinal plant, comprising two varieties, the *Large* and the *Small*.

Culture, &c. — When raised in gardens, it is easily propagated by seed. It prefers a gravelly, sandy, or chalky soil. Every part of it is poisonous.

HOREHOUND. — This herb has a white, hoary appearance, and a very bitter, though not unpleasantly aromatic, flavor.

Culture, &c. — Any common soil is adapted to this plant, and it is readily increased by divisions of the roots, or by seeds.

HYSSOP. — There are three varieties, the *White*, *Red*, and *Blue* — distinguished by the color of the flowers. The last is the most common.

Culture, &c. — A dry soil is the most appropriate one. It is propagated by seed and slips of the branches and young shoots, as well as by offsets. May be sown from early spring until June; rooted offsets may be planted in March, April, August, and September; cuttings of the branches in April and May, and slips of young shoots in June or July. Sow broadcast, or in drills, six inches apart, and not deeper than an inch.

LAVENDER. — A dwarf, odorous shrub, of three or four years' duration.

Fig. 109.



Culture, &c. — The soil should be a poor, dry, limy gravel; the seeds being

sown in a garden in spring, may be transplanted in September or March following, in rows two feet apart. The second season they will yield flowers, and a full crop the fourth, after which the plants will continue productive for years. The spikes are gathered in June, and dried in the shade.

LIQUORICE. — The liquorice is a deep-rooting plant, with stems four or five feet high.

Fig. 110.



Culture, &c. — The soil should be a deep, sandy loam, trenched two or three feet deep, and manured; the plants consist of the side roots, having eyes or buds. Plant in the fall or spring, in rows three feet apart, and from eighteen inches to two feet in the row; hoe, stir, and weed, and carry off the stems every autumn, after they are completely withered.

MARJORAM. — The *Sweet Marjoram* is a biennial plant, and long in use as a seasoning for soups, and for other culinary purposes.

Culture, &c. — This species, being somewhat tender, is commonly sown on a slight hot-bed towards the end of March, or on a warm border about the middle of April; in the former case, transplanting it into rows one foot apart, and the plants six inches distant in the row; and in the latter case, thinning them out, without transplanting.

MINT. — The *Common* or *Spear Mint* is a creeping stemmed plant, the young leaves of which are much used in salads, soups, &c.

Culture, &c. — Propagate by dividing the roots before they begin to grow in the spring, and bury in shallow drills, or slip off the young shoots when they are three or four inches long, and plant in beds a few inches apart. To produce tender stalks and leaves, water liberally. To dry, cut the stalks when just coming into flower.

PARSLEY.—A well-known biennial, with a large, sweet tap-root. There are two varieties, the *Plain-leaved* and the *Curled-leaved*, the latter the best

Fig. 111.



Culture, &c.—Sow at monthly intervals, from February until middle of June, in drills nine inches apart; when of tolerable growth, thin to nine inches asunder, and keep clear of weeds. For seed, cut in July or August; dry, and beat out.

PENNY-ROYAL.—There are two kinds, the *Trailing* and the *Upright*.

Culture, &c.—It is grown by dividing the roots in the spring. The best soil is one that is strong and moist. It is of very easy cultivation.

PEPPERMINT.—A well-known creeping-stemmed plant, growing spontaneously.

Culture, &c.—It may be propagated by dividing the roots early in the spring, and planting in a soft, rich soil. The stalks are gathered when in full flower.

PURSLANE.—There are two sorts, the *Green* and the *Golden*, the latter being used mostly as a garnish, and the former for a salad; also for pot-herbs and pickles.

Culture, &c.—Where a constant supply is required, the first sowing should be made on heat in February, and the others monthly, on a warm border, till August. The shoots are gathered when from two to five inches high, and well furnished with leaves.

ROSEMARY.—The *Green*, *Golden-striped*, and *Silver-striped*, are the varieties cultivated, the first-named being the most used.

Culture, &c.—The best soil is a poor, light, limy one. Propagate by

cuttings and rooted slips, during any of the spring months, or by layers in the summer. Sow in March or April, in drills one inch deep, and six inches apart. The slips and cuttings must be five or seven inches long, and planted in rows eight or ten inches apart. Water liberally at the time of planting, and occasionally afterwards.

RUE. — An evergreen shrub, making a beautiful garnish for table dishes.

Culture, &c. — It thrives best in a poor, clayey soil, and is propagated by slips, cuttings, and seeds, in the spring, the seed being sown in drills one inch deep, and one foot apart. The slips or cuttings may be planted on a poor, shady border, and watered occasionally.

SAFFRON. — This is also called the *Autumn Crocus*, and is a bulbous-

Fig. 112.



rooted perennial, which has been long cultivated for its medical and culinary uses.

Culture, &c. — Plant the bulbs on a prepared soil, not poor nor a very stiff clay. Plant in July, in rows six inches apart across the ridges, and three inches distant in the rows. The flowers are gathered in September, the stigmas picked out, together with a portion of the style; these are dried between layers of paper, under the pressure of a thick board, to form into cakes.

SAGE. — The varieties are the *Common Green*, *Wormwood*, *Variegated Green*, *Variegated Red*, *Painted* or *Parti-colored*, *Spanish* or *Lavender-leaved*, and *Red*.

Culture, &c. — It is propagated by seeds or cuttings, and the plantation ought to be renewed every two or three years; otherwise, the winter may destroy it.

SAVORY. — There is the *Winter* or *Perennial Savory*, and the *Summer* or *Annual Savory*, the latter being preferred, on account of its more agreeable fragrance.

Culture, &c. — The *Winter savory* is propagated by seed, cuttings, or divisions, — most frequently by the latter mode. The *Summer* is sown in drills, one foot apart, in the open garden, in March or April.

TANSY. — The *Curled* or *Double Tansy* is the kind chiefly grown for culinary use.

Culture, &c. — The kind of soil is not very material. It is raised by rooted slips, or divisions of its roots, planted in spring and in autumn, in rows a foot apart each way. A little manure will increase the productiveness, but is not wholly necessary.

THYME. — The *Common* and *Lemon Thyme* are the two varieties.

Culture, &c. — The *Common* is readily increased by seeds, cuttings, or divisions, and the plants should be renewed, by one or other of these modes, every year, in the spring. The *Lemon* is a trailing evergreen, used for the same purposes as the preceding.

KITCHEN GARDEN CALENDAR.

JANUARY. — *Artichoke*: secure from frost, if not yet done. *Asparagus*: plant on a hot-bed twice in the month, to keep up a succession. *Carrot*: sow on a slight hot-bed. *Cauliflower*: sow in a box, and place in a forcing-house, if the autumn sowing failed. *Celery*: protect during severe weather. *Cucumbers*: prepare a seed-bed for sowing next month, renew the linings of the fruiting-beds, and keep them made up above the surface of the soil in the frame. *French Beans*: sow in pots, for forcing. *Mint* and other *Herbs*: take up and plant in pots or boxes, and place in a forcing-house. *Potatoes*: plant on a slight hot-bed. *Radishes*: sow on a slight hot-bed, or in the same frame with potatoes. *Rhubarb*: take up old roots, and plant in boxes or pots, and place them in a forcing or mushroom house.

FEBRUARY. — *Beans*: plant in boxes for turning out next month; also sow in the open ground, if the season be open. *Cabbage*: sow on a warm border. *Carrots*: sow on a warm border. *Cauliflowers*: prick out those sown in boxes last month on a slight hot-bed, — sow on a sheltered border. *Celery*: sow in boxes, and place in a forcing-house, for a first crop. *Cucumbers*: plant from the seed-bed, and afterwards keep the heat by night 70° to 75°, and by day, 75° to 85°. *French Beans*: earth up former sowings, and sow again. *Lettuce*: sow on a warm border. *Mushrooms*: make beds and spawn at 80°. *Onions*: sow in boxes, and place in a forcing house, for planting out in April. *Peas*: sow in boxes, and in the open

ground. *Potatoes* :—plant on a slight hot-bed and on a warm border. *Radishes* : sow on a warm border. *Sea-Kale* : cover up. *Spinach* : sow. *Turnips* : sow.

MARCH. — *Artichokes* : make new plantations. *Asparagus* : make new beds,—top-dress the latter end of the month. *Basil* : sow. *Beans* : plant twice in the month. *Beets* : sow. *Cabbages* : fill up vacancies in the autumn plantations. *Capsicums*, or *Peppers* : sow seed. *Carrots* : sow the main crop. *Herbs* : make new beds. *Horse-Radish* : make new plantations. *Jerusalem Artichokes* : plant early in the month. *Leek* : sow. *Lettuce* : prick out on a slight hot-bed those sown last month in boxes. *Mushrooms* : make beds for summer use. *Onions* : sow the main crop. *Parsley* : sow. *Parsnips* : sow the main crop. *Peas* : sow twice,—earth up early crops. *Potatoes* : plant main crop. *Radishes* : sow twice. *Salsify* : sow. *Savoy* : sow beginning and end. *Scorzonera* : sow. *Shallots* and *Garlic* : plant the beginning of the month. *Spinach* : sow. *Turnips* : sow on a sheltered border.

APRIL. — *Beans* : plant twice, and earth up the early crop. *Borecole* : sow. *Broccoli* : sow the winter varieties. *Brussels Sprouts* : sow beginning of the month. *Cabbages* : prick out the February sowing. *Cardoons* : sow for early crop. *Cauliflowers* : plant out those wintered in frames. *Celery* : prick out the early sown on a slight hot-bed. *Cucumbers* : sow to plant out on ridges. *French Beans* : sow the beginning of the month. *Lettuce* : fill up the autumn plantations. *Onions* : transplant the autumn sowing, and also those sown in boxes in February. *Peas* : sow twice in the month, earth up, and stick early crops. *Radishes* : sow twice in the month. *Spinach* : sow first and third week. *Turnips* : thin, and sow the latter end. *Vegetable Marrow* : sow the middle of the month.

MAY. — *Basil* : plant on a rich sheltered border. *Beans* : top the early crops,—plant twice in the month. *Beets* : thin to fifteen inches apart. *Borecole* : prick out of the seed-bed. *Broccoli* : prick out those sown last month, and make another sowing of the winter kinds; also Cape and Granges, the last week. *Cabbages* : plant out the February sowing. *Cauliflowers* : earth up, and water with liquid manure,—take off the hand-glasses. *Cucumbers* : prepare ridges for out-door crops. *French Beans* : make sowings the first and last weeks. *Leeks* : transplant. *Lettuce* : transplant early sowings,—sow twice in the month. *Onions* : thin them to nine inches apart. *Peas* : make two sowings. *Potatoes* : earth up the early crops. *Radishes* : make two sowings. *Spinach* : sow the middle of the month,—thin former sowings. *Scarlet Runner* : sow beginning and middle of the month. *Turnips* : make a sowing, if not done the end of last month.

JUNE. — *Asparagus* : discontinue cutting. *Beans* : put in the last crop,

—top and earth up former crops. *Broccoli*: sow Cape and Granges *Cabbage*: sow seed for Coleworts. *Capsicums*: plant out on a warm border. *Carrots*: thin to two inches apart. *Celery*: transplant into trenches for an early crop. *Cucumbers*: plant under hand-glasses *Endive*: sow for an early crop. *French Beans*: make a sowing the middle of the month. *Leeks*: transplant. *Lettuce*: transplant. *Peas*: complete the sowing of the marrow varieties. *Potatoes*: earth up. *Radishes*: sow as in last month. *Savoys*: transplant for an early crop. *Scarlet Runners*: make the last sowing. *Spinach*: sow twice. *Tomatoes*: turn out against walls. *Vegetable Marrow*: plant under hand-glasses.

JULY. — *Borecole*: transplant. *Broccoli*: transplant. *Brussels Sprouts*: transplant. *Cauliflower*: transplant from the April sowing. *Cabbage*: sow in the last week for a crop to come in in May. *Celery*: transplant into trenches. *Endive*: make a second sowing. *French Beans*: earth up, and make the last sowing the latter end of the month. *Lettuce*: make a sowing the first and last week. *Peas*: make two last sowings of early sorts. *Radishes*: sow on a cool border.

AUGUST. — *American Cress*: sow to stand the winter. *Borecole* and *Broccoli*: transplant the main crop. *Cabbage*: sow for main spring crop, — transplant for Coleworts. *Carrots*: sow to stand the winter. *Cauliflowers*: transplant to come in during autumn, — sow for the main spring crop. *Celery*: transplant into trenches, and earth up for blanching. *Endive*: make the last sowing, and transplant from former sowings. *Lettuce*: sow for standing through the winter, — transplant from former sowings. *Onions*: sow for standing through the winter. *Radishes*: sow the winter varieties. *Savoys*: transplant the main crop. *Scarlet Runners*: earth up and stick. *Spinach*: sow the main winter crop. *Turnips*: sow the winter crop.

SEPTEMBER. — *Cabbages*: prick out from last month's sowing. *Celery*: earth up for blanching. *Chervil*: sow for winter use. *Curled Cress*: sow for winter use. *Endive*: transplant, and tie up for blanching. *Mushrooms*: make beds for winter use. *Onions*: pull up and house them when dry. *Parsley*: cut down a portion of the spring sowing. *Potatoes*: take up the early sorts. *Purslane*: sow for winter use. *Shallots* and *Garlic*: these should now be taken up. Dig up vacant ground.

OCTOBER. — *Artichokes*: tie up the leaves for producing the chard. *Asparagus*: cut down and winter dress. *Beets*: dig up and lay in sand. *Cabbages*: plant out for the main crop. *Cardoons*: tie up the leaves for blanching. *Carrots*: take up the main crop. *Cauliflower*: prick out under hand-glasses, and into frames. *Cucumbers*: make beds, and sow seed for early crops. *Lettuce*: plant out for the main spring crop. *Parsnips*: take

up and preserve in sand. *Potatoes*: take up the main crops. *Tomatoes*: gather the unripe fruit, and lay in a forcing-house. Dig and trench ground during dry weather.

NOVEMBER. — *Artichokes*: cover the roots with litter. *Beans*: sow first crop. *Cauliflowers*: protect those which have formed heads from the frost. *Celery*: take every favorable opportunity to earth it up. *Cucumbers*: ridge out the plants in the fruiting-beds. *Endive*: preserve from frost. *Horse-radish*: dig up for winter use. *Jerusalem Artichokes*: take up for winter use. *Peas*: sow for an early crop. *Salsify*: dig up for winter use. *Scorzonera*: dig up for winter use. *Sea-Kale*: clear away the decayed stems and leaves. Preserve culinary vegetables from frost.

DECEMBER. — *Asparagus*: take up roots for forcing. *Celery*: protect during severe frosts. *Cucumbers*: attend to the linings of the beds. *French Beans*: plant in pots for forcing. *Mushrooms*: keep a moist and steady temperature in the house. *Radishes*: sow on a hot-bed for early use. *Rhubarb*: take up roots, and pot for forcing. *Sea-Kale*: take up roots carefully for forcing. *Small Salad*: keep a succession, by sowing once a week, Prepare materials for hot-beds.

CHAPTER V.

THE DAIRY.

DAIRY IMPLEMENTS — MANAGEMENT — MILK — BUTTER-MAKING — CHEESE-MAKING; INCLUDING ALL THE MOST CELEBRATED AND ESTEEMED MODES.

IMPLEMENTS.

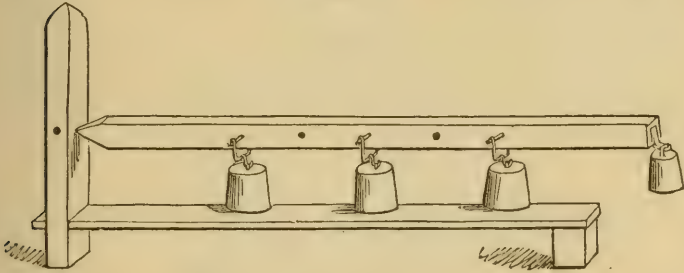
General Remarks. — The construction of dairy-houses is, naturally, the first subject to be presented, in a chapter like this. The reason why it is here omitted is, in order that it may be included in the chapter on RURAL ARCHITECTURE, thus enabling us to give consistency and completeness to the plan of this volume. We begin, therefore, with remarks on some of the implements or utensils employed in dairy operations. These comprise milk-pails, shallow pans or cooling dishes for holding, sieves for straining the milk when taken from the cow, dishes for skimming the cream, churns for the making of butter, besides scales, prints, and boards, for weighing, measuring, and ornamenting it; also ladders, vats, tubs, curd-breakers, and presses, for the manufacture of cheese, together with vessels large enough to hold the whey or butter-milk. Almost all of these, except the churn and press, are so generally similar, and so familiar to all, as to require but little description. The material of which most of these are formed is wood, though many dishes are made of earthen-ware, lead, tin, freestone and slate, and not unfrequently of brass.

It being generally conceded that the dairy husbandry of England is the most perfect in the world, we shall incorporate as much information relative to its management in that country, in the present chapter, as will be compatible with the limits assigned to this department.

Presses. — The cheese-presses act upon the curd by pressure, and are there usually made of stone, of different weights, proportioned to the size of the cheese. They are most generally raised by a block and tackle, but are frequently made upon the principles of the lever, and there are various constructions, placed in frames of wood, also of iron. A very common machine, of an extremely simple form, used in many dairies which produce such small cheeses as not to require great pressure, is that of a movable beam, fixed by a pivot in an upright post, and having hooked on at the other end a

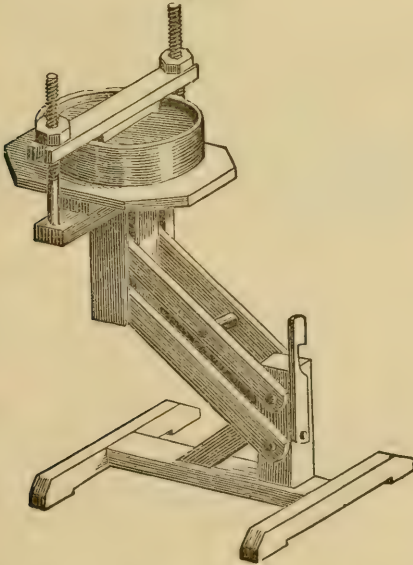
weight which presses in this manner on the cheese-vats underneath (Fig. 113). There is also the Patent Self-Acting Press, which is much used. It

Fig. 113.



is light, but strong, and is substantially a table on which to turn the cheese; no forcing screws, nor lifting heavy weights, but the cheese creates a con-

Fig. 114.

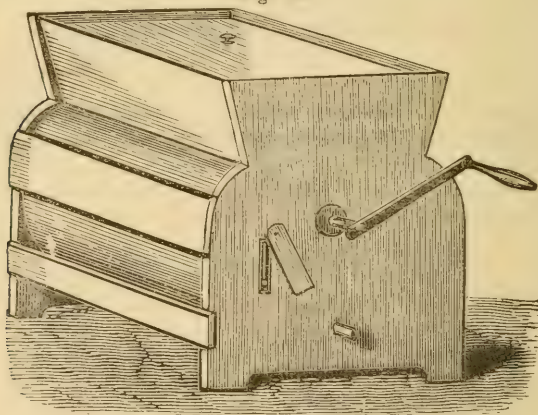


stant and regular pressure, of twelve times its own weight, whether large or small; and, if a greater pressure is needed, one pound laid upon the

cheese or table adds twelve pounds increased pressure, and so on. The cheese is not removed from the press until the pressing is completed.

Churns. — The *churns* are closed vessels, into which the cream, or the whole milk, being put, a piston, or a wheel in the form of a fan, is quickly and regularly moved, either up and down, or by turning, according to its form, so as to separate the oily particles of which the butter is composed. They are generally made of the best oak, and of various sizes. Much improvement has been made, within a few years, in the construction of churns, figures of three of which we annex.

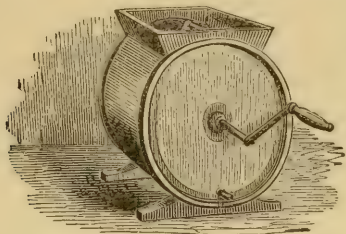
Fig. 115.



The *Thermometer churn* (Fig. 115) is constructed so that the cream or milk is readily brought to the desired temperature without mixing water or other substances, and the temperature certainly and definitely determined, which proves invaluable in making butter. There is a double bottom, made in the form of a semi-circle, of two sheets of zinc, or other metal, placed one above the other, the cream to rest upon the uppermost; between the two sheets forming the bottom is a space or chamber, into which may be introduced cold or warm water, as may be required, to increase or diminish the temperature of the cream or milk. The water is easily applied by means of a common tin tunnel, through an aperture or hole in the side of the churn. Another improvement is a thermometer permanently placed in one end of the churn, secure from injury, marked at sixty-two degrees, and which is always visible, so that the operator may know when the cream or milk is brought to the proper temperature. If too warm, the mercury will rise

above the mark, and cold water should be applied in the chamber described; if too cold, the mercury will fall below the mark, when warm water must be used in the same manner. The cream or milk should be stirred or agitated, by turning the crank, while the water is being introduced, to give an

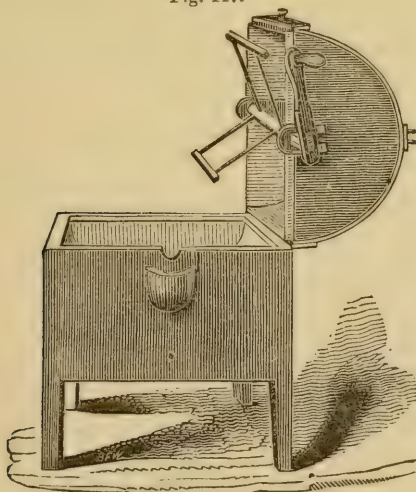
Fig. 116.



equal temperature throughout. When the thermometer indicates that the cream or milk is of the proper temperature, the water may be drawn out through the tube placed for the purpose, when the churning should be performed by giving the crank about forty revolutions to the minute.

Kendall's Cylindrical Churn (Fig. 116) is simple in its construction, and

Fig. 117.



combines all the advantages of other cylindrical churns, with this improvement, that the revolving dasher can be taken out in a moment, whenever

it is required to be cleansed. There are five sizes, from two to twenty gallons.

The *Gault Churn* is an article much in use, and in some respects a superior machine. Fig. 117 represents the top lifted up to receive the cream or discharge the butter. *Tillinghast's* is also an almost incomparable churn.

Cleanliness in Dairying. — The form of these utensils is, however, a matter of secondary importance, compared with their being kept extremely clean, which is the chief requisite in all the operations of the dairy; and, therefore, those which can be most readily cleaned are the best to be employed, whatever may be their shape. Those who superintend dairy operations should be clean and careful, and the floor of the dairy should be kept perfectly dry; for water thrown down in hot weather will rise again in steam, and affect the milk with its humidity.

MILK.

Management of Milk. — When the milk has been drawn from the cow, it should be carried as gently as possible to the dairy, and after being there strained through the sieve, it must then be deposited in shallow pans or coolers, not exceeding three or four inches in depth, where it is left to collect the cream, which rises to the surface within a few hours, according to the temperature of the air. Those who are particularly nice, either in the consumption of the raw cream, or for the making of butter, skim it, perhaps, within twelve hours; but it is more generally left full twenty-four, or even thirty-six hours, according to the state of the season, when intended for butter, and is then not unfrequently skimmed again.

The chief component parts of milk are those which, when separated, are known as forming butter and cheese, the residue of which is called whey. These parts are known, however, to vary in percentage, according to the quality of the milk; and, to determine this point, what is called a *lactometer* is in use. It consists of glass tubes placed upright in a wood frame; these tubes are divided and subdivided, by marks, into equal spaces; they are filled to equal height, each with the milk of a particular cow, when, after remaining a proper time, the quantity of cream in each is readily seen through the glass, and the exact difference determined by the marks; this, however, does not show whether the *caseous* matter (of which cheese is formed) or the *butyraceous* matter (or oily substance producing cream) predominates. The following observations may be assumed as a summary of its management: *First* — Of the milk that is drawn from any cow at a time, that which comes off at the first is always thinner and of a poorer quality than that which comes afterwards, the richness continually increas-

ing, to the last drop drawn at that time. *Second*—If milk be put in a dish and allowed to stand till it throws up cream, that portion of cream which rises first to the surface is richer in quality and greater in quantity than what rises in a second equal portion of time; the cream that rises in the second interval of time is greater in quantity and richer in quality than that which rises in a third equal space of time; and that of the third than the fourth, and so on; the cream that rises decreasing in quantity, and declining continually in quality, so long as any rises to the surface. *Third*—Thick milk always throws up a smaller proportion of the cream it actually contains to the surface than milk which is thinner; but that cream is of a richer quality. If water be added to that thick milk, it will also afford a considerably greater quantity of cream than it would have done if allowed to remain pure; but its quality is at the same time greatly debased. *Fourth*—Milk which is put into a bucket, or other proper vessel, and carried to any considerable distance, so as to be much agitated, and in part cold, before it is put into the milk-pans to settle for cream, never throws up so much nor so rich cream as if the same milk had been put into the pans directly after it was milked. *Fifth*—If it be intended to make butter of a very superior quality, it will be, in such case, advisable to separate the milk that is first drawn from that which comes last, and the quality will be improved in proportion to the smallness of the last-drawn milk that is obtained. The first-skimmed cream should also be used, as it is always richer than that which rises last.

BUTTER.

General Remarks.—This is formed either by cream alone, or with the whole milk, unskimmed; but although such different modes of manufacture might seem to warrant very different results, yet they have very little perceptible effect on the quantity or quality, though the profit on the produce of the dairy may be affected, in large towns, by the greater demand for skim-milk or butter-milk. There is also another kind, which is much inferior, and made from the cream of whey, after the cheese has been taken from the milk; but the process of making is nearly the same.

Cream Butter.—When butter is to be made from cream alone, the milk is, in winter, usually skimmed as often as four, and in summer two or three times, or until it will afford no more cream; and this should be first separated from the edges of the pan, to which it firmly adheres, by means of an ivory or silver-bladed knife, run closely around it. The cream should then be carefully drawn to one side and lifted off with a skimming-dish, which is generally pierced with small holes; an act which requires some dexterity,

both to avoid the leaving of any cream behind, and to prevent any portion of the milk being mixed with it. Some persons, indeed, have leaden coolers, with a plug in the bottom, which allows the milk to escape to a large vessel underneath, while it leaves the cream at top ; but the former practice is most usual.

The length of time which the milk should stand before it is skimmed must depend both upon the temperature of the air at the time, and the views of the dairy operator. In moderately warm weather, if very fine butter be intended, it should not be suffered to remain more than six or eight hours ; for ordinary good butter, it may be safely allowed to stand full twelve hours, and during cold weather, much longer. The cream is then put into a deep vessel, in which it is frequently stirred, every day, with a wooden spoon, in order to prevent coagulation, until sufficient be collected to form a churning. No vessel can be better adapted for this purpose than one in the under part of which, close to the bottom, there is a faucet and peg for draining off, from time to time, any thin, serous part of the milk that may chance to be there generated ; for should this be allowed to remain, it acts upon the cream in a powerful manner, and greatly diminishes the richness and quality of the butter. The inside of the vessel should be covered with a bit of close, fine silver-gauze, to keep back the cream, while the whey is allowed to pass. Many persons imagine that no butter can be of good quality except that which is made from fresh cream ; the fact, however, being, that the formation of butter takes place only after the cream has attained a certain degree of acidity, and no butter of even tolerable quality can be obtained from cream that is not more than one day old. The length of time which the cream should be kept before it acquires that degree of acidity which is requisite for the best butter, depends so much upon the weather, that no fixed rule can be laid down. In fact, so little nicety is observed, in this respect, by practical farmers, even those who have a high reputation for making good butter, that few of them ever think of observing any precise rule with regard to the different portions of their cream, seeing they in general make into butter all they have collected since the former churning ; the time which should intervene between one churning and another being usually determined by local or accidental circumstances. If the cream be very carefully kept, and no serous matter be allowed to lodge about it, a very great latitude may be safely admitted in this respect. It is, indeed, certain, that cream which has been kept three or four days in summer is in excellent condition for making into butter, and that from three days to seven may be found in general to be the best time for keeping cream before churning. The cream from every milking should, however, be kept apart until it is become sour, and not be mixed up with sweet cream, — at least, not until

the moment of churning, — for the mixture occasions fermentation, which, though partly prevented by the stirring, is liable to render the cream putrid. When, however, the herbage is coarse, or the cows are fed on roots, or artificial grasses, the sooner the cream is churned, the better will be the butter. Sometimes the milk is allowed to stand until the cream becomes clotted, or, as it is termed, “carved,” to a proper degree of acidity, which generally takes place, in warm weather, within a day or two; and, in winter, it is placed near the fire, in order to forward that process.

Clotted Cream. — The mode of procuring the genuine clotted or “clouted cream,” which is said to produce one fourth more cream than by the common way, is as follows: The milk, while warm from the cow, is strained into either large, shallow brass pans, well tinned, or earthen ones, holding from two to five gallons, in which should be a small quantity of cold water, which prevents burning, and causes the cream to be more completely separated and thrown to the top. The morning meal of milk stands till about the middle of the day; the evening meal, until the next morning. The pans are now steadily carried to and placed over a clear, slow fire, which, if of charcoal, or over a stove, the cream is not so apt to get an earthy or smoky taste as when the milk is scalded over a turf or wood fire. The milk must not boil, as that would injure the cream. The test of its being sufficiently scalded is a very nice point; the earthen pan, having its bottom much smaller than the top, allows this point to be more easily ascertained, because, when the milk is sufficiently scalded, the pan throws up the form of its bottom on the surface of the cream. The brass pan, if almost as big at the bottom as at the top, gives no criterion to judge by, but the appearance and texture of the cream at the surface, the wrinkles upon which become smaller, and the texture somewhat leathery. In summer, it must be observed, the process of scalding ought to be quicker than in winter, as, in very hot weather, if the milk should be kept over too slow a fire, it would be apt to run or curdle. This process being finished, the pans are carefully returned to the dairy, and, should it be the summer season, they are placed in the coolest situation; if on stone floors, the better; but should it be the winter season, the heat should rather be retained, by putting a slight covering over the pans, as cooling too suddenly causes the cream to be thin, and consequently yields less butter, the mode of making which is this: The cream should, in hot weather, be made into butter the next day; but in winter it is thought better to let the cream remain one day longer on the milk. The cream, being collected from the pans, is put into wooden bowls, which should be first rinsed with scalding, then with cold, water. It is now briskly stirred round one way, with a nicely-cleaned hand, which must also have been washed in hot and then in cold water; for these alternate warm and cold

ablutions of bowl and hand are not only for the sake of cleanliness, but to prevent the butter from sticking to either. The cream, being thus agitated, quickly assumes the consistence of butter; the milky part now readily separates, and being poured off, the butter is washed and pressed in several cold waters; a little salt is added to season it, and then it is well beaten on a wooden trencher until the milky and watery parts are separated, when it is finally formed into prints for the market.

In the common way of making butter from cream, the dairies churn the whole quantity at once; but in many dairies, celebrated for the quality of their butter, only the first skimmings are used in making the best kind, the mode pursued being as follows: The milk, after standing twenty-four hours in large shallow coolers, lined with lead, is skimmed; the skimmed milk is then drawn off from the leads into other vessels of increased depth, but unlined, in which it is left from twelve to twenty-four hours, during which time it is skimmed two or three times; this is called "doubling;" it is then "trebled," or put into tubs, or still deeper vessels, where it is occasionally skimmed, so long as any appearance of cream is found to form upon the surface; after which, it is given to the pigs. The butter which is made from the after-skinmings is paler and inferior to that made from the cream cast up within the first rising; it is therefore generally churned apart.

Whole-Milk Butter. — If butter be made from the whole milk, the process, in the best dairies, in which the consumption of butter-milk is considerable, is to place the milk, when drawn from the cow, in coolers on the floor of a clean, cool, well-aired milk-house, from twelve to twenty-four hours, till it has cooled to the temperature of the milk-house, and the cream has risen to the surface; these coolers are next emptied, while the milk is yet free from acidity, into a clean, well-scalded vat, of size to contain the whole milking, or two milkings, if both are sufficiently cooled, where it remains till churned. If another milking, or meal of milk, be ready before that which has begun to become sour, that second meal may be put into the same vat; but if the first has soured, or is approaching to acidity, before the second quantity has completely cooled, any further admixture would lead to fermentation, and injure the milk. It is necessary that the whole milk become sour before it is churned, but the whole of it must become so of its own accord, and by no means forced into acidity by any mixture of sour milk with that which is sweet. The utmost care should, however, be taken, not to allow the coagulum, or curd, of the milk in the stand-vat, to be broken till the milk is about to be churned. If it be not agitated, or the "lapper" (as it is termed in dairy language) broken, till it is turned into the churn, it may stand from a day to a week without injury.

Churning. — The operation of *churning*, whether it be cream or whole

milk, is done in the same manner; but the latter, from being so much the larger quantity, is of course so much more laborious, that in large dairies churns moved by machinery are frequently used, and which, besides the advantage of performing the work with great regularity, also produce a larger quantity of butter. The whole milk, besides, requires more time than that of cream to complete the process— from two to three hours being considered necessary to effect it with due deliberation, while that of cream is generally finished within less than an hour and a half. The operation should, in warm weather, be very slow, for if it be done too hastily, the butter will be soft and white; the churn should, therefore, be cooled by being previously filled with cold water; but in winter it should, on the contrary, be performed quickly, and the churn should be warmed. The motion of the churn should be, in each case, regular, and whatever may be the degree of velocity, the stroke of the fan, or piston, ought always to be the same, until the butter is formed, or said “to come.” The air which is generated in the churn should also be occasionally allowed to escape, or it will create froth, which impedes the process.

The temperature of the milk-house should be kept, as nearly as possible, at about 55° , or at least between 50° to 60° ; and cream, when churned alone, should not be higher, for if kept at a high temperature in the process of churning, it will be found inferior in appearance, taste, and quality; but milk and cream, when churned together, it is generally thought, must be equalled to about 70° to 75° , before the latter can be separated from the milk, which is consequently the common practice. This is done by one person pouring gradually a small quantity of warm water into it, while another is churning; for if the work be carried on while too cold, the milk is said to rise in the churn, air-bubbles are thrown up with a rattling noise, and the milk becomes pale; whereas, if conducted at a proper heat, it does not swell, but is easily worked, and remains at the proper straw-color. A thermometer, it may therefore be imagined, should always be hung up in every dairy; yet, strange to say, it is an instrument seldom seen in any of them; the only scale which the dairy-maid knows is at her fingers' ends, and although she invariably trusts to her hand for trying the heat, it is yet surprising with what correctness she usually judges. Practice, it is said, makes perfect; and it is astonishing with what accuracy many operations, which are supposed by theorists to demand the aid of science, are performed, through experience, by the merest child in science. Notwithstanding, however, the accuracy which experience may produce, it is not to be compared with that denoted by scientific experiment, nor can it be acquired without great loss of time, which might otherwise be avoided.

The whole milk, as well as the cream when churned separately, must

become sour before it is churned ; but this must be effected merely by the state of the atmosphere, or by being kept exposed to the fire, in order to bring on fermentation. It is therefore kept in a large vat, or tub, until the milk is turned into curd, or lapper, and if that remains undisturbed, the churning may be deferred for some days longer ; the warm water must not, therefore, be added until the curd is broken. In some dairies, the milk is put into a pan, or vat, and well stirred with a wooden spoon, or ladle, two or three times a day, to prevent the cream from separating from the milk ; and this sort of stirring, or partial churning, is continued till the milk becomes so thick and clotted that the ladle stands erect in it, after which, it is put into the churn for an hour or so ; cold water is also poured in, to help collect the butter and separate the milk from it.

Washing Butter. — In most places, the butter, when taken from the churn, is washed in repeated waters, in order to extract the milk, until the water comes out pure. This, however, is a practice not generally commended, for it has been found, by long experience, that butter retains its sweetness much longer when no water is used in making up. When it is taken out of the churn, it is well worked with the hand, which presses out most of the milk ; it is then beaten with a cloth, or rather a cloth is repeatedly pressed down upon it, which absorbs all the remaining milk. The less it is beaten or worked, however, the better ; for the more it is kneaded, the more tough and gluey will it become ; and a slight quantity of salt may be added to flavor it.

Salting. — If the butter be salted for market, after the whole of the milk has been carefully pressed out, it should be well mixed, by working it in by the hand, with finely-powdered salt ; for if care be not taken in mixing it equally, the butter acquires different colors—yellow where the salt has fallen, and white where it has not—which kind is, of course, inferior. The operation should be performed immediately, for, if deferred, as it commonly is by country dealers, and farmers who do not churn enough to fill a firkin at once, the butter loses a portion of its firmness and flavor. Should, however, there not be enough to fill up a package, the butter should never be put into the firkin in layers, but the surface should be left every day rough and broken, so as to unite better with that of the succeeding churning. The quality may also be in a great measure preserved by giving it a partial salting, and covering it over with a clean linen cloth, dipped in pickle, and placed in a cool situation.

The quality of salt should be strong marine, free from the brine of mineral salt. The quantity may be that of about ten ounces to fourteen pounds of butter,—rather more or less according to the length of time which the butter is intended to be preserved ; but it is generally thought that the butter made

during the summer months is the fittest for salting, and that the sort which is made in the latter part of the season, not taking it so well, requires rather more. Some farmers use saltpetre, in the proportion of half an ounce of salt with one eighth of saltpetre to the pound of sixteen ounces; and, although this forms a valuable pickle, if the salt be really good, yet it unquestionably would be much improved if four ounces of raw sugar were to be added to each pound weight of salt. A compound of one part sugar, one part nitre, and two parts of the best Spanish salt, beat together into a fine powder, and mixed thoroughly with the butter, in the proportion of one ounce to the pound, has been found to keep the butter in every respect sweet and sound, during two years that it was in cask. It is also said to impart a rich marrowy flavor that no other butter ever acquires, and tastes but very little of the salt.

When the butter is cured, it is then tramped firmly, with a round wooden stick, into the firkin, which is filled up to the head, and then covered over with a little of the purest salt.

CHEESE.

General Remarks. — As butter is made from the oily part of the milk which rises to the surface in the form of cream, so cheese is composed from the curd, or coagulated milk, and may be obtained from the caseous part alone, after the milk has been skimmed. If thus deprived of the cream, this “skim-milk” cheese is, however, of a poor quality; and if intended to be good, the whole milk should be used, without any loss of cream; for, if any portion of it be abstracted, the cheese will be proportionably less rich, — consequently, less palatable, and of inferior value. The mode of making, too, though in the main points apparently the same, yet is subject to more variety of minor details in the practice than that of anything formed of one material, and thus many different qualities are carried to market, each bearing some distinct character of its own. That many of those kinds which are by connoisseurs thought indifferent might, by other management, be more nearly assimilated to the superior sorts, there can be little doubt; these peculiarities, however, have, in some cases, attached a certain degree of value to their flavor, while in others it would seem to be imparted by the natural grasses grown upon the soil. This applies more especially to some places. It is well known that where brine-springs most abound the cheese is always esteemed to be of superior quality.

Rennet. — *Different Modes of Preparing and Treating.* — Although cheese may be made from the curd which has been formed by the coagulation of the milk when it turns sour, yet, when thus obtained, it is hard and ill-flavored; means have, therefore, been found to curdle it with “rennet,” which is made from the gastric juice of animals, but more especially from

that found in the maws or stomachs of sucking calves, that have been fed entirely upon milk. These maws, or "vells," as they are sometimes called, are occasionally preserved, along with the curd contained in them by salting; but the more usual mode is to employ the skins of the stomach bags alone, the method being to put a few handfuls of salt into and around the stomachs, which are then rolled up and hung near the chimney to dry, after which, they are put by for a long time before they are used. If the skin be good, a bit of it no larger than a half-dime, if put into a tea-cup, filled with water, with a little salt, during about twelve hours before it is wanted, will form a stock sufficient for eighteen or twenty gallons of milk; but their manner of preservation and use is extremely various, and, as the quality of the cheese depends more upon the application of the rennet than upon any other part of the manufacture, we shall here state some of the most approved modes of its preparation.

Most dairy-maids are of the opinion that if the curd, or chyle, were not removed from the maw of the calf, it would communicate a harsh taste to the cheese; and some intelligent operators never use the vells until they are a year old, for, if newer, the rennet made from them causes the cheeses to heave, or swell, and to become full of eyes, or holes; and it is well known that, if too much be used, or if it be unusually strong, it will occasion the cheese to heave, probably by causing fermentation. It is, therefore, sometimes prepared by adding to every six vells two gallons of brine, and two lemons, the latter doing away with any unpleasant smell, and giving it an agreeable flavor. A large quantity should be made at a time, and it should never be used until it has stood at least two months.

Another mode is, to take the maw of a newly-killed calf, and clean it of its contents; salt the bag, and put it into an earthen jar for three or four days, till it form a pickle; then take it from the jar and hang it up to dry, after which it is to be replaced in the jar, the covering of which should be pierced with a few small holes to admit of air, and let it remain there for about twelve months. When wanted for use, a handful each of the leaves of sweet-briar, dog-rose, and bramble, with three or four handfuls of salt, are to be boiled together in a gallon of water for a quarter of an hour, when the liquid is to be strained off and allowed to cool. The maw is then to be put into the liquid, together with a lemon stuck around with cloves; and the longer it remains in it, the stronger and better will be the rennet, half a pint, or less, of the liquor, is sufficient to turn fifty gallons of milk.

Another mode practised is, when the rennet-bag is fit for the purpose, let two quarts of soft water be mixed with salt, wherein should be put almost every sort of spice and aromatic herb that can be procured; and must boil gently until the liquor is reduced to three pints, when it should be

strained clear from the spices, and poured, in a tepid state, upon the maw, and a lemon may be sliced into it. It may remain a day or two, after which it should be strained again, and put into a bottle, where, if well corked, it will keep good for twelve months or more, and give the cheese a pleasing flavor.

Still another practice is this: when the maw comes from the butcher, it is always found to contain a chyly or curd-like matter, which is frequently salted for present use; but when this chyly matter is taken out, and the skin cleaned from slime, and every apparent impurity, by wiping or a gentle washing, the skin is then filled nearly full of salt, and placing a layer of salt upon the bottom of a mug, the skin is placed flat upon it. The mug is large enough to hold three skins in a course, each of which should be covered with salt; and when a sufficient number of skins are thus placed in the mug, it should be filled up with salt, and put, with a dish or plate over it, into a cool place, until the approach of cheese-making season in the following year. The skins are then all taken out, laid for the brine to drain from them, and, being spread upon a table, they are powdered on each side with fine salt, and are rolled smooth with a paste-roller, which presses in the salt. After that, a thin splint of wood is stuck across each of them, to keep them extended while they are hung up to dry. In making the rennet, a part of the dried maw-skin is, in the evening previously to its being used, put into half a pint of luke-warm water, to which is added a little salt. In the morning, this infusion — the skin being first taken out — is put into the tub of milk; but so great is the difference in the quality of these skins, that it is difficult to ascertain what quantity will be necessary for the intended purpose. A piece the size of half a crown, cut from the bottom of a good skin, will commonly be sufficient for a cheese of sixty pounds' weight, though ten square inches of skin are often found too little. It is customary, however, to cut two pieces from each skin, one from the lower, the other from the upper part; but the bottom end is the stronger.

An improved mode is, to take all the maw-skins provided for the whole season, pickled and dried as before, put them into an open vessel, and for each skin pour in three pints of spring water; let them stand twenty-four hours, then take out the skins and put them into other vessels; add for each one pint of spring water, and let them stand twenty-four hours, as before. On taking the skins out the second time, gently stroke them down with the hand into the infusion, and they are then done with. Mix these two infusions together, pass the liquor through a fine linen sieve, and add to the whole a quantity of salt rather more than is sufficient to saturate the water, that is, until a portion of salt remains undissolved at the bottom of the vessel. The next day, and also the summer through, the scum, as it

rises, is to be cleaned off, and fresh salt should be added. Somewhat less than half a pint of this preparation will generally be sufficient for sixty pounds of cheese ; but, when for use, the whole should be well stirred up.

In some places, however, so far from washing away the chyle contained in the maw of the calf, pains are taken to increase it as much as possible, by giving to the animal as much milk as it can be made to swallow, a few hours before it is killed ; for, the chyle being formed by the mixture of the gastric juice with the food, and that gastric juice being the coagulating power, both are therefore carefully preserved, and are considered as thus forming a stronger rennet than can be drawn from the bag alone. When the stomach or bag is taken from the calf's body, its contents are examined, and if any straw or other food be found among the curdled milk, such impurity is removed ; but no part of the chyle is suffered to be lost. At least two handfuls of salt are put into the bag, and upon its outside, after which it is rolled up in salt, and hung near a fire, where it is always allowed to hang until it is well dried ; and it is understood to be improved by hanging a year, or longer, before being infused. When rennet is wanted, the "yirning," as it is sometimes called, with its contents, is cut small, and put into a jar, with a handful or two of salt, and a quantity either of soft water that has been boiled, and cooled to about 65°, or of new whey taken off the curd, is put upon the bag in the jar. The quantity of water, or whey, to infuse the bag, is more or less, according to the quality of the yirning. If it is that of a new-dropped calf, that has not been fed, three pints will be enough ; but if he has been fed for four or five weeks, a couple of quarts may, at least, be put on the bag to wash ; it should, however, be observed that the yirning of a calf four weeks old yields more rennet than that of one twice that age. After the infusion has remained in the jar from one to three days, the liquid is drawn off, and a pint more water, or whey, put on the bag in the jar ; and that, after standing in mash one or two days, is also drawn off, and, with that of the first infusion, strained, if any impurities appear in the liquor ; the whole being put up in bottles for use as rennet, and the bag being thrown away, without ever being put into the milk. Some put about a drachm of whiskey into each quart bottle of the rennet ; and it may be either used immediately, or kept for as many months as may be convenient. A table-spoonful of rennet thus made will, it is said, coagulate thirty gallons of milk ; but its great superiority over our common practice is, that it will curdle the milk in five or ten minutes. As to the chyle occasioning a harsh taste to the cheese, the reverse is the fact. It must, however, be admitted, that, unless great care be employed in the immediate preparation of rennet thus made

the curd is extremely apt to become rancid, and thus impart a certain degree of rankness to the cheese.

Whole-milk Cheese. — The mode of making sweet-milk cheese — that is, cheese made of milk which has not been skimmed — is, to put the ladder across the cheese-tub, with a large canvas-cloth covering the whole, in order to prevent the falling of milk upon the floor, or any other matter into the tub, and above this is placed the sieve through which the milk is to be strained. It should be of the temperature of 90° to 95° ; and if below 85° , a portion of it should be placed in a deep brass pan, which is then immersed in the water, which is kept hot in the wash-house. By this means the whole is warmed equally, and it is of the utmost importance that attention be paid to it; for, if the milk be not warm enough when the rennet is put to it, the curd will be tender, and the cheese will bulge out at the sides; and, if too hot, it will cause it to swell or heave, and become spongy, both of which defects are injurious to its appearance and quality. The rennet is then at once added to the milk, which is thus coagulated at its natural heat; but many farmers have not cows enough to form a cheese at every milking, and it must, therefore, be then allowed to cool. In doing this, it of course throws up cream, which is not unfrequently taken off for butter, while the second meal, of whole milk, is used along with that which has been already skimmed; but if the cheese be intended to be of fine quality, the cream must be also added. This, however, should be at the same time skimmed; for the milk, when cooled, must be afterwards heated to full 90° in the summer, and to a higher temperature in cold weather; and, were the cream to be warmed to that degree, it would be melted, which would cause a considerable portion of the fatty or butyraceous matter to be lost in the whey. It is, therefore, generally thought the best practice to gradually bring it to a liquid state by the admixture of moderately warm milk, before it is poured into the cheese-tubs. The curd is then broken into small pieces, and the whey being thoroughly squeezed out, it is salted, wrapped in a cloth, and placed in a chessart, of such size as may be convenient, or is usually made in the neighborhood; it is then pressed with weights proportionate to its size, and turned occasionally, until it becomes sufficiently firm to be taken out of the mould, and placed either on a cheese-rack, or on the floor of the cheese-room, where it is occasionally turned, and dry-rubbed with salt, and remains until fit for the market.

Drying. — New cheese requires to be hardened by gradual drying before it becomes fit for market; and the cheeses, when taken out of the mould, are, for this purpose, spread in a single layer on the floor of the cheese-loft, where they are daily turned by hand, in order to expose each surface alternately to the air. This, on a large dairy-farm, is a slow and laborious operation, which, as it devolves upon hired help, sometimes prevents them

from paying proper attention to that essential duty. A machine has, therefore, been invented to remedy this inconvenience, called a Swing Frame, which consists of a dozen strong shelves framed together, and having bars nailed from top to bottom of one side of the back of the shelves, in order to prevent the cheeses from falling out while in the act of turning. The frame is suspended on two strong pivots, one of which is let into the wall of the room, and the other is supported by a strong post. Two catches keep the frame upright, and prevent it from being turned more than half around. By first filling the shelf immediately below the axis of the frame, and then placing the cheeses alternately on the two nearest shelves above and below that which has been already filled, the preponderance of one side over the other can never be more than the weight of one cheese; the whole power, therefore, required to turn the machine, cannot, in any circumstances, be greater than this and the friction of the pivots. The cheeses, in the act of turning, drop upon those shelves, which, in the former position of the frame, were above them, and, having been exposed to a current of air for twenty four hours previously, have become perfectly dry. The benefits of the machine are, that, by means of it, fifty-five cheeses are turned in the same time which is required for turning two by hand; that a room thus furnished will hold treble as many cheeses as when they are laid on the floor; that the shade afforded by the shelves, together with the current of air which passes between them, has the effect, in hot weather, of preventing excessive sweating, and consequently loss both in weight and quality, as well as diminishing the necessity of rubbing the cheeses; and, lastly, the ripening of the cheeses is hastened, so that, on an average, they are ready for market five weeks earlier than usual.

The Store-room.—The store-room should be kept temperately warm, and the shelves on the floor upon which the cheeses are laid should be strewn with dry moss, or fine hay, as the cheeses, when new, are otherwise apt to adhere to the boards, and thus acquire an unpleasant appearance. At a more advanced stage they may be laid upon straw; but, at first, it would sink into the surface and deface them. The dried leaves of the tutsan, or of the yellow star of Bethlehem, and the twigs of the common birch-tree, are also thought to assist in preventing the depredations of mites.

Green Whey.—The whey which runs from the curd without pressure is called "green whey," and is received from the cheese-tub into pans covered with a cloth, under which they are held, until it deposits a sediment, which is added to the curd, after which it is poured into the cistern; while that which is pressed by hand from the curd is termed "white whey," and contains a considerable portion of oily matter; so much so, that

it is in some cases kept apart, and set for cream. Most generally, however, the green and white are both scalded together, until they throw up a substance in appearance between cream and curd, which is skimmed off so long as it rises, to be churned for *whey-butter*, the difference between which and milk-butter is something in favor of the latter.

MODE OF MAKING THE CELEBRATED CHEESES.

In all our dairies the same main points are admitted to be essential ; but, although the means of attaining them are nearly alike in similar sections of country, yet in others they differ materially in the minutiae ; and as upon these much of the art of cheese-making depends, we give the details of the modes employed on some of the most celebrated descriptions of cheese, believing that it will be of material value to every American farmer, to be acquainted with the *modus operandi* of producing the finest articles of dairy labor.

Cheshire Cheese.—The *Cheshire* cheese is generally made with two meals of milk, even in dairies where two cheeses are made in a day ; indeed, in the beginning and end of the season, three, four, and even five or six meals, are kept for the same cheese. The general custom is, to take about a pint of cream, when two-meal cheeses are made, from the night's milk of twenty cows. In order to make cheese of the best quality, and in the greatest abundance, it is, however, admitted that the cream should remain in the milk ; for whether the cream that is once separated from it can by any means be again so intimately united with it as not to undergo a decomposition in the after process, admits of a doubt. The more common practice is, to set the evening's milk apart till the following morning, when the cream is skimmed off, and three or four gallons of the milk are poured into a brass pan, which is immediately placed in the furnace of hot water, and made scalding hot ; then half of the milk thus heated is poured upon the night's milk, and the other half is mixed with the cream, which is thus liquefied, so as, when put into the cheese-tub, to form one uniform fluid. This is done by the dairy-woman while the others are milking the cows, and the morning's milk being then immediately added to that of the evening, the whole mass is at once set together again for cheese.

The rennet and coloring being then put into the tub, the whole is well stirred together, a wooden cover is put over the tub, and over that is thrown a linen cloth. The usual time of "coming," or curdling, is one hour and a half, during which time it is frequently to be examined. If the cream rises to the surface before the coming takes place, as it often does, the whole must be stirred together so as to mix again the milk and the cream ; and this as often as it rises, until the coagulation commences. If the dairy-

woman supposes the milk to have been accidentally put together cooler than she intended, or that its coolness is the cause of its not coming, hot water, or hot milk, may be poured into it, or hot water in a brass pan may be partially immersed in it. This must, however, be done before it is at all coagulated, for the forming of the curd must not be tampered with. If it has been set together too hot, the opposite means, under the same precautions, may be resorted to ; but the more general practice is to suffer the process to proceed, hot as it is, until the first quantity of whey is taken off, a part of which, being set to cool, is then returned into the tub to cool the curd. If too little appears to have been used, it renders the curd exceedingly bitter, and therefore an additional quantity may be put in ; but this must be done before the coagulation takes place, for, if added afterwards, it will be of little effect, as it cannot be used without disturbing the curd, which can then only acquire a proper degree of toughness by having some heated whey poured over it. For coloring, Spanish annatto is the drug usually employed, little more than the quarter of an ounce being sufficient for a cheese of sixty pounds. Other coloring matters are, however, used, such as marigolds boiled in milk, which gives a pleasant flavor, and carrots also boiled in milk and strained, which imparts a rich color, but a rather strong taste. The annatto is generally put in by rubbing a piece of it in a bowl with some warm milk, which is afterwards allowed to stand a little, in order to drain off the sediment, and is then mixed with the entire quantity.

Within an hour and a half, as already mentioned, if all goes on well, the coagulation will be formed — a point which is determined by gently pressing the surface of the milk with the back of the hand ; but in this test experience is the only guide, for the firmness of the curd, if the milk be set hot together, will be much greater than that from milk which has been set cold together. If the curd be firm, the usual practice is to take a common case-knife, and make incisions across it to the full length of the blade, at the distance of about one inch, and again crosswise in the same manner, the incisions intersecting each other at right angles. The cheese-maker and two assistants then proceed to break the curd, by repeatedly putting their hands down into the tub, and breaking every part of it as small as possible, this part of the business being continued until the whole is uniformly broken small. It generally takes up about forty minutes, and the curd is then left, covered over with a cloth, for about half an hour, to subside.

The bottom of the tub is now set rather a-tilt, the curd is collected to the upper side of it, and a board is introduced, of a semi-circular form, to fit loosely one half of the tub's bottom. This board is placed on the curd, and a sixty-pounds' weight upon it, to press out the whey, which, draining to the lower side of the tilted tub, is ladled out into brass pans. Such parts of the

curd as are pressed from under the board are cut off with a knife, placed under the weighted board, and again pressed; the operation being repeated again and again, until the whey is entirely drawn from the curd. The whole mass of curd is then turned upside down, and put on the other side of the tub, to be pressed as before. The board and weight being removed, the curd is afterwards cut into pieces of about eight or nine inches square, piled upon each other, and pressed both with the weight and hand; these several operations being repeatedly performed, as long as any whey appears to remain in it.

The next thing is to cut the curd into three nearly equal portions, one of which is taken into a brass pan, and is there by two persons broken extremely fine, a large handful of salt being added, and well mixed with it. That portion of curd being sufficiently broken, is put into a cheese-vat, which is placed to receive it, on a cheese-ladder over the cheese-tub, the vat being furnished with a coarse cheese-cloth. The second and third portions of the curd are treated in the same manner, and emptied into the vat, except that into the middle portion eight, nine, or ten times the quantity of salt is usually put. By some, however, each portion is salted alike, and with no more than three large handfuls to each. The breaking takes up more or less time, as the cheese was set together hotter or colder; half an hour is, perhaps, the longest.

The curd, when put into the cheese-vat in its broken state, is heaped above the vat in a conical form; to prevent it from crumbling down, the four corners of the cheese-cloth are turned up over it, and three persons, placing their hands against the conical part, gently, but forcibly, press it together, constantly shifting their hands when any portion of the curd is starting from the mass, and folding down the cloth upon it. So soon as the curd adheres together so as to admit of it, a small square board, with a corner of the cloth under it, is put on the top with a sixty-pounds' weight, or a lever, such as that which has been described, is pressed upon it. Several iron skewers are at the same time stuck in the cone, as well as through holes in the side of the vat, from which they are occasionally drawn out and fixed in other spots, until not a drop of whey is discharged. The weight and skewers are then removed, and the corners of the cloth are held up by hands, or by a wooden hoop, while the curd is broken as small as possible, half way to the bottom of the vat, and the same operation of pressing and skewering is repeated. The four corners of the cloth are then taken up, while the vat is drawn away, and rinsed in warm whey; a clean cloth is then put over the upper part of the curd, and it is returned inverted into the vat; it is then broken half way through in the same manner as before, which several operations occupy from three to four hours.

When no more whey can be extracted by these means from the cheese, it is again turned in the vat, and rinsed as before in warm whey. The cloth now made use of is finer and larger than the former, and is so laid that on one side it shall be level with the edge of the vat, and on the other wrap over the whole surface of the cheese; the edges being put within the vat, thus perfectly enclosing the entire mass. In this stage of the business the cheese is still higher than the edge of the vat; and, to preserve it in due form, recourse is had to a binder, about three inches broad, either as a hoop or as a cheese-fillet, which is a strong, broad, coarse sort of tape, which is put around the cheese, on the outside of the cloth, and the lower edge of the binder pressed down within the vat, so low as that the upper edge of it may be level with the surface. The cheese is then carried to the press, and a strong, smooth board being placed over it, the press is gently let down upon it, the usual power of which is about fourteen or fifteen hundred weight. In most dairies there are two presses, and in many three or four, of different weights, the cheese being by some put first under the heaviest, and by others under the lightest.

As soon as the cheese is put into the press, it is immediately well skewered, the skewers being of strong wire, eighteen or twenty inches long, sharp at the points and broad at the other end, the vat and binder having holes, seldom more than an inch asunder, to receive them. As the press always stands near the wall, only one side of the cheese can be skewered at the same time, and it must therefore be turned half way round, whenever that is necessary; but this occasions no inconvenience, as the skewers must be frequently shifted, and many more holes are made than skewers to fill them. In half an hour from the time when the cheese is first put into the press, it is taken out again, and turned, in the vat, into another clean cloth: after which it is returned to the vat, but is by some persons previously put naked into warm whey, where it stands an hour or more, for the purpose of hardening its coat. At six o'clock in the evening, the cheese is again turned in the vat into another clean cloth, and some dairy-women prick its upper surface all over an inch or two deep, with a view of preventing blisters. These, however, if they occur, can be remedied by opening them with a penknife and pouring hot water into the incision; then press down the outer rind, put on a little salt, and place a piece of slate with a half-pound weight upon it. At six o'clock in the next morning, it is again turned in the vat, with a clean cloth as before, and the skewers are laid aside; it is also turned two or three times more, both morning and evening, at the last of which finer cloths are used than those at first, in order that as little impression as possible may be made on its coat.

After the cheese has remained about forty-eight hours under the press, it

is taken out, fine cloth being used merely as a lining to the vat, without covering the upper part of the cheese, which is then placed nearly mid-deep in a salting-tub, its upper surface being covered all over with salt. It stands there generally about three days, is turned daily, and at each turning well salted, the cloth being changed twice in the time. It is then taken out of the vat, in lieu of which a wooden girth, or hoop, is made use of, equal in breadth to the thickness nearly of the cheese, and in this it is placed on the salting-bench, where it stands about eight days, being well salted all over, and turned each day. The cheese is then washed in lukewarm water, and, after being wiped, is placed on the drying-bench, where it remains about a week; it is then again washed and dried as before, and after it has stood about two hours, it is smeared all over with about two ounces of sweet whey-butter, and then placed in the warmest part of the cheese-room. On the cheese coming into the salting-house, it is, in some dairies, taken out of the vat, and after its sides are well rubbed with salt, is returned into the vat with a clean fresh cloth under it; the top being covered with salt, it is placed on the salting-benches, turned and salted twice a day, and the cloth changed every second day. On the salting-benches it is continued seven or eight days, when it is taken out of the vat, and with a wooden hoop, or cheese-fillet, around it, is put into the salting-tub, and managed as before described.

While it is remaining in the warmest part of the cheese-room, it is, during the first seven days, rubbed every day all over, and generally smeared with sweet butter; after which it should for some time be turned daily, and rubbed three times a week in summer, and twice in winter.

The details of this process, however, apply only to cheeses of sixty pounds' weight, and the quantity of salt used to them is uncertain. The greatest is about three pounds each; but much of it is wasted, and whether the cheese acquires much saltiness in the salting-house, dairymen themselves are doubtful, though much salt is there expended. Respecting the heating of the milk, the practice must evidently vary according to the weather. The sponginess and heaving of the cheese, which are sometimes complained of, are faults which are to be attributed more to inattention on the part of the operators than to want of actual skill, — the remedy being careful breaking, good thrusting, frequent skewering, and powerful pressing; they not improbably arise partly from the use of cold and warm milk, which, if mixed together, will generate air. Those of pungency and rankness, which are commonly imputed to impurity in the rennet, and by some to the want of salt, may be also more properly ascribed to the fermentation occasioned by the imperfect discharge of the whey.

Gloucester Cheese. — When the curd is sufficiently firm for breaking, it

is gently and slowly cut crosswise, to the bottom of the tub, at about an inch apart, with a three-bladed knife of fourteen inches long. When it has stood five or ten minutes, to allow it to sink a little, and the whey to come out as clean as possible, some of the whey is dipped out of it with a bowl, and the curd is again cut. This must also be at first done slowly, and with strokes at a considerable distance from each other, for, if performed hurriedly, a great sediment of curd will be found in the whey-leads; it should, however, be gradually quickened, and the strokes taken nearer and nearer every time, one hand with the skimming-dish keeping the whole in motion, and turning up the lumps suspended in the whey, while the other cuts them as small as possible. This process may occupy a quarter of an hour.

The curd is now allowed to settle during a quarter of an hour, when the whey is taken from it, and poured through a very fine sieve placed over the whey-leads, the curd being then cut into lumps, from which most of the remaining whey escapes. The curd is then pressed down with the hand into vats, which are covered with large cheese-cloths of fine canvas, and placed in the press for half an hour, after which they are taken out, and the curd put into a mill, which tears it into small crumbs, and saves the laborious part of squeezing and rubbing it with the hands, while it also retains that portion of the oily matter which would be otherwise lost to the cheese, and thus occasions a great improvement in the making.

In this pulverized state it is customary to scald the curd with hot whey, though some consider the cheese richer when not scalded, for this washes out a part of the fat. The whey should, nevertheless, be completely extracted, and the curd fitted into the vat as compactly as possible, being rounded up in the middle, but only just so much as that it can be pressed down to a level. A cheese-cloth is then spread over the vat, and a little hot water is thrown over the cloth, as tending to harden the outside of the cheese, and prevent it from cracking. The curd is now turned out of the vat into the cloth, and the inside of the vat being washed in whey, the inverted curd, with the cloth around it, is again returned to it; the cloth is then folded over, and the vat put into the press, where it remains about two hours, after which it is taken out and dry cloths applied, which should be repeated in the course of the day; it is then replaced in the press until the cheese is salted, which is generally done within twenty-four hours after it is made.

The salting is performed by rubbing the entire cheese with finely powdered salt; for if the curd be salted before being put into the vat, its particles do not intimately unite, and although it may become a good cheese, it is loose and crumbly, and never becomes a smooth, close, solid mass, like that which has been salted after it has been made: but this is never done

until the skin is closed, for if there be any crack in it at that time, it will not afterwards close. The cheese is after this returned to the vat and put under the press, in which more cheeses than one are placed together, care being always taken to put the newest lowest in the press, and the oldest uppermost. The salting is repeated three times, — the cloths being removed after the second, in order to efface their marks, — and twenty-four hours are allowed to intervene between each; thus the cheese is within five days taken from the press to the cheese-room, though in damp weather it should remain somewhat longer. There it is turned every day for a month, when it is ready for cleaning, which is done by scraping with a common knife, the operator sitting down to perform the operation. When it has been cleared from all scurf, it is rubbed all over with a woollen cloth dipped in paint made of Indian red, or Spanish brown, and small beer; and as soon as the state of the paint will permit, the edge of the cheese, and about an inch on each side, are rubbed hard with a cloth, every week. The quantity of salt is generally about three and a half pounds to the hundred weight, and one pound of annatto is enough for half a ton of cheese.

The true characteristics of the double Gloucester cheese consist in its great richness, together with the mildness of its flavor, and that waxy texture which makes it cut, even in thin slices, without crumbling; while its oily matter is retained in toasting, by merely softening itself, without being burned.

Stilton Cheese. — This article, so proverbial for its richness, is made by putting the night's cream, without any portion of the skimmed milk, to the milk of the following morning; but those who wish to make it very fine add a still greater quantity of cream, and of course the richness of the cheese depends upon the amount which is used. Butter is also said to be sometimes mixed with it. The rennet is then added, without any coloring; and, when the curd has come, it is taken out without being broken, and put whole into a sieve, or drainer, where it is pressed with weights until entirely cleared of whey. When dry it is put, with a clean cloth, into a hooped chessart, and placed under the press, the outer coat being first salted. When sufficiently firm to be removed from this mould, the cheese is placed upon a dry board, and tightly bound in a cloth, which is changed daily, in order to avoid all danger of cracks in the skin, until this is found to be tolerably well coated, after which it is no longer used, and the cheese requires no further care than being frequently turned upside down, and occasionally brushed.

The cheeses of this kind, although not much larger than the crown of an ordinary sized hat — the form of which they much resemble — and not weighing more than about a dozen pounds, yet require nearly two years to bring

them to maturity ; for they are not generally thought sufficiently mellowed for use until considerably decayed ; and, in order to forward their ripeness, it is said that, besides their being placed in damp but warm cellars, they are sometimes wrapped in strong brown paper, and sunk in a hot-bed. It is also stated that the flavor of an old cheese may be communicated to a new one, of whatever species, by some portions being intermixed with it. This is done by extracting small pieces, with the sample-scoop, from each cheese, and interchanging them ; by this means, the new one, if well covered up from the air, will in a few weeks become thoroughly impregnated with the mould, and with a flavor hardly to be distinguished from the old one. The cheeses selected for this operation should, however, be dry, and the blue mould should be free from any portion of a more decayed appearance.

Dunlop Cheese. — The Dunlop has acquired a high reputation for its mild richness, and is made as follows : When so many cows are kept on one farm as that a cheese of any tolerable size may be made every time they are milked, the milk is passed, immediately as it comes from them, through a sieve into the vat, and, when the whole is collected, it is formed into a curd by the mixture of the rennet. Where, however, the cows are not so numerous as to yield milk sufficient to form a cheese at each meal, the milk of another meal is stored about six or eight inches deep in coolers, and placed in the milk-house. The cream is then skimmed from the milk in the coolers, and, without being heated, is put into the curd-vat, along with the milk just drawn from the cows, and the cold milk, from which the cream has been taken, is heated so as to raise the temperature to about blood-heat. This, indeed, is a matter of great importance ; and though in summer 90° may be sufficient, yet, upon the average of winter weather, 95° will be generally found requisite. If coagulated much warmer, the curd becomes too adhesive, much of the butyraceous matter is lost in the whey, and the cheese will be found dry, tough, and tasteless ; but if too cold, the curd, which is then soft, does not part readily with the serum, and the cheese is so wanting in firmness that it is difficult to be kept together ; indeed, even when the utmost pains are taken to extract the whey, and give solidity to the cheese, holes — which, in dairy language, are termed “ eyes,” “ whey-drops,” and “ springs ” — frequently break out, rendering them either rancid or insipid.

About a table-spoonful of the liquid rennet is generally thought sufficient for twenty-five gallons of milk, and the curd is usually formed by it within twelve or fifteen minutes, though in some dairies — of course, in consequence of the difference of strength in the rennet — it does not come from three quarters of an hour to an hour, though double the quantity of rennet is used. The curd is then broken with the skimming-dish, or with the hand, and the whey ought to be taken off as speedily as possible, though without pressing,

as the least violence has been found to make it come off white, and thus weaken the quality of the cheese. The best method of separating the whey from the curd is, in the first instance, to lift the edge of the cheese-tub, and let the whey run off slowly from it into a vessel placed underneath. The tub is then let down to stand a little, after which it is turned one fourth round, and another collection emptied off; thus, by turning the tub a fourth time round every time, it is found to part from the curd more pure and quickly.

When quite freed from the whey, and the curd has acquired a little consistence, it is then cut with the cheese-knife, gently at first, and more minutely as it hardens, after which it is put into the drainer (which is a square vessel, with small holes in the bottom, and a cover to fit inside), or which the lid is placed, with a cloth thrown over it; and a slight pressure — say from forty to fifty pounds, according to the quantity of curd — being laid on, it is allowed to stand from fifteen to twenty minutes, or half an hour. It is then cut into pieces of two inches square, the whey is again discharged, and the weight, being doubled, is replaced. The process of cutting it smaller every half hour, and increasing the weight until the pressure is upwards of a hundred pounds, is continued for three or four hours. It is then cut very small, and minutely salted, half an ounce being sufficient.

A clean cheese-cloth, rinsed in warm water and wrung out, being then placed in the chessart, the cheese is turned upside down, and laid, with increased weight, under the press, during the whole night. Next morning, and during the three or four days which it must remain in the press, it is daily turned repeatedly, dry cloths being each time used, and the weight is gradually increased, until the pressure amounts to at least a ton.

When ultimately taken from the press, the cheeses are generally kept during a week or ten days in the farmer's kitchen, where they are turned three or four times every day, and rubbed with a dry cloth. They are then removed to the store-room, which should be in a cool exposure, between damp and dry, without the sun being allowed to shine upon them, or yet a great current of air admitted; this gradual mode of ripening being found essential to prevent the fermentation and heaving of the cheese, as well as the cracking of the rind; but attention must be paid to rub them with a dry cloth, and turn them daily for a month or two, and twice every week afterwards.

Practical Suggestions. — Such, then, are the most usual modes of manufacturing the world-renowned cheeses to which we have alluded, in which the difference employed is in some cases very striking and important. Thus, in the preparation of rennet, the bag itself is in some places used

while elsewhere the liquid decoction extracted from it is so much stronger that it occasions the curd to coagulate, as we have just seen, within fifteen minutes ; and in other places, it occupies an hour and a half, and not unfrequently more than two hours. Now, it is not only the delay which is thus disadvantageous ; for it is well known that the degree of heat at which the curd is set is one of the nicest points in cheese-making, and we can hardly imagine how that can be properly regulated, if it be allowed to stand so long cooling in the cheese-tub.

The temperature to which the last night's milk is heated when there is not sufficient to make a cheese that one meal, and the mode in which the cream is managed, differ also in various dairies ; nor does there appear any objection to the practice of making the last night's milk into cheese, provided it be so gradually heated as that the cream does not run the risk of being converted into oil, as it does if too suddenly heated ; yet we believe that, when once separated from the milk, the cream can never again be so completely blended with it as to be entirely retained in the curd when set ; it consequently runs off with the whey, and leaves the cheese of inferior quality.

The skewering of the curd, as practised in some dairies, is unknown in most other places ; and the labor of several persons employed for three or four hours in thrusting or hand-pressing it into the vat is an operation which is generally managed in other dairies with a couple of maids, and in one quarter of the time.

The heaving of the cheese is attributed to the imperfection of its fermentation, occasioned in a great measure by the store-rooms — though commonly placed over the cow-house — not being sufficiently heated, so as to occasion its sweating ; yet, in the account of the Dunlop cheese, objection is made to heated stores, as causing an improper degree of fermentation.

The rankness of flavor, which is mostly attributed to the impurity of the rennet, is by others ascribed to the nature of the pasture. In this, both suppositions may be right ; for it must be evident that it may be readily occasioned by the use of a large quantity of badly-prepared rennet ; and we learn from the management of one of the dairies, where every means were taken to avoid the fault, that the cheese still maintained an unpleasant taste of the same description, which could, therefore, have only arisen from the herbage. It was, however, at length uniformly overcome by throwing about half a tea-spoonful of saltpetre into the pail before the cows were milked. The cracks which frequently take place in cheese are also by many persons supposed to proceed from lime having been used as a manure upon land laid down to pasture, and afterwards fed by cows ; but this is probably a mistake, for it rarely occurs in the Dunlop sort, though perhaps as much lime has been applied to the soil where that description is made as

to any other. It is more probably owing to the cheese being exposed, before it is dry, to too much draught of air.

The mode of salting is also very differently conducted in several dairies; in some the practice being to cure the cheese after it has been removed from the vat, while in others the salt is minutely mixed into the curd previously to its being put into the vat. Both practices, nevertheless, appear to be attended with equally good effects, but the latter certainly occasions less trouble, without any waste of salt.

Skim-milk Cheese.—This article, made of milk from which the entire of the cream has been taken, is, of course, more or less palatable in proportion to the time during which the milk is allowed to stand; for if that be so long as to deprive it entirely of the butyraceous or oily matter, it becomes indigestible, and so hard that, in some places, where large quantities of it are made, it is said that, instead of being cut with a knife, it is usually chopped with a hatchet.

The milk should, if possible, not be allowed to become sour; and the moment it has been skimmed, it should be heated to no more than animal heat, or about 90° ; for, if put together too hot, its toughness will be increased, and as the curd coagulates more readily than that of full-milk cheese, the same degree of heat is not necessary. This is the chief perceptible difference in management, except that the curd is more difficult to be broken, and that the cheese needs less of the press; but in all other respects the mode of making is the same. It will also be sooner ready for use than whole-milk cheese of the same weight.

Cream Cheese.—This being, in general, only wanted for immediate use, is, in fact, little else than thick, sweet cream, dried by being put into a small cheese-vat of about an inch and a half in depth, perforated with small holes in the bottom, to allow any portion of the milk which may be mixed with it to escape. It is also covered with rushes, or the long grass of Indian corn, so disposed as to admit of its being turned without being handled, and it is never pressed except gently by the hand between cloths. It is thus kept in warm situations to sweat and ripen; for, if once penetrated by frost, or even chilled, much of its mellow richness is lost, and it becomes comparatively insipid. The extreme of heat should, however, be equally guarded against, or it becomes rank; and, therefore, some judgment is requisite in the time for using it in perfection.

New Cheese.—New cheese is only made in the early part of summer, when the cows have been turned out to grass, and is formed entirely of new milk, with about one third of warm water added before the rennet is put to it. The whey is then gently poured off, and the curd is carefully kept entire until put into a vat of considerable diameter, but only about an inch

in depth. It is very gently pressed for a few hours only, and when removed from the vat, it is covered with a cloth, which is frequently changed, and so soon as the skin is formed it is considered fit for use.

Parmesan Cheese. — This is prepared as follows: The cows are kept in the house nearly the whole year round, and fed during the summer with cut grass, and in the winter upon hay. The weight of these cheeses varies from sixty to one hundred and eighty pounds; it consequently requires a great number of cows to produce one of even the smallest weight, and as the farms in that territory are not large, the dairymen club together.

The mode of making is this: The summer cheese, which is the best, is made of the evening milk, after having been skimmed in the morning, and at noon, mixed with the morning milk, which is also skimmed at noon. Both kinds of milk are poured together into a large copper cauldron, of the shape of an inverted bell, which is suspended on the arm of a lever, so as to be moved on and off the fire at pleasure. In this vessel the milk is gradually heated to the temperature of about 120° , after which it is removed from the fire and kept quiet for a few minutes, until all internal motion has ceased. The rennet is then added, which is composed of the stomach of a calf, fermented together with wheaten meal and salt, the method of using it being to tie a piece, of the size of a hazelnut, in a rag, and steep it in the milk, while held in the hand, and squeezing it from time to time. A sufficient quantity of the rennet thus soon passes through the rag into the milk, which is now to be well stirred, and afterwards left at rest to coagulate.

Within about an hour the coagulation is complete, and then the milk is again put over the fire, and raised to a temperature of 145° . During all the time it is heating, the mass is briskly stirred, till the curd separates in small lumps, when a part of the whey is taken out, and a few pinches of saffron are added to the remainder, in order to color it. When the curd is sufficiently broken, nearly the whole of the whey is taken out, and two pailfuls of cold water are poured in. The temperature is thus lowered, so as to enable the operator to collect the curd by passing a cloth beneath it, and gathering it up at the corners. It is now pressed into a frame of wood, placed on a solid platform, and covered by a round piece of wood fitting into the mould, with a heavy weight at top. In the course of the night it cools, parts with the whey, and assumes a firm consistence. The next day one side is rubbed with salt, and the succeeding day the cheese is turned, and the other side rubbed in like manner, this alternate salting being continued for about forty days. After this period, the outer crust of the cheese is pared off, the fresh surface is varnished with linseed oil, the convex side is colored red, and the cheese is fit for market.

Potato Cheese. — Cheese, which is said to be of very fine quality, is partly formed from potatoes, being made in the following manner : — The potatoes of a large, white kind, are those to be preferred, and after being boiled, they are peeled, when cool, and reduced to a pulp, of equal consistence, either by being grated or ground in a mortar. To five pounds of this pulp there is added one pound, or about a pint, of sour milk, with the usual quantity of salt to impart a flavor ; the whole is then kneaded together, and, being covered up, is allowed to remain for three or four days, according to the season. At the expiration of this time, the pulp is again kneaded, and placed in one or more small wicker baskets, in order to get rid of the superfluous moisture ; the pulp is then moulded into form by being placed in small pots, in which the cheeses are allowed to dry in the shade during about fifteen days, after which they are put in store. The older they are, the better they become ; and, if kept dry, they will keep for a great number of years. Three kinds of this cheese are made : the first, or most common, according to the above proportions ; the second, with four parts of potatoes and two parts of curdled milk ; and the third, with two parts of potatoes and four of milk. Ewe-milk is as frequently employed as that of cows, and imparts a pungent taste, which to many palates is found agreeable.

Green or Sage Cheese. — The method pursued in the making of this article is, to steep over night, in a proper quantity of milk, two parts of sage, one part of marigold-leaves, and a little parsley, after they have been bruised. On the following morning, the *greened* milk is strained off, and mixed with about one third of the whole quantity intended to be run or coagulated. The green and white milks are run separately, the two curds being kept apart, until ready for vating ; these may be mixed, either evenly and intimately, or irregularly and fancifully. The management is the same as for common cheese.

CHAPTER VI.

FRUITS, FRUIT-TREES, VINES, &c.

STANDARD KINDS :— APPLE — APRICOT — BARBERRY — BLACKBERRY — CHERRY — CRANBERRY — CURRANT — GOOSEBERRY — GRAPE — MEDLAR — MELON — MULBERRY — NECTARINE — PEACH — PEAR — PLUM — QUINCE — RASPBERRY — STRAWBERRY. MISCELLANEOUS KINDS :— ALMOND — BLUEBERRY — BUTTERNUT — CHESTNUT — FIG — FILBERT — LEMON — LIME — OLIVE — ORANGE — POMEGRANATE — SHELLBARK — WALNUT — WHORTLEBERRY ; — WITH A MONTHLY CALENDAR OF OPERATIONS.

THE APPLE.

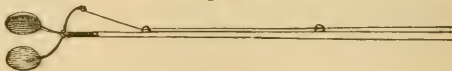
Propagation.— The apple may be propagated by seeds, cuttings of the branches or roots, by layers, suckers, in arching, grafting, or budding ; but the last two modes are principally for *continuing* varieties, and seeds are used to obtain *new* varieties.

Soil and Situation.— It will grow in any common soil, neither too sandy gravelly, nor clayey, on a dry subsoil, and a free exposure.

Mode of Bearing, &c.— The apple bears invariably on the old wood often on that of the preceding year ; and the blossoms continue being produced from terminal and lateral spurs, or short, robust shoots, many years. These spurs require to be thinned out when they become crowded, to be shortened when they become too long, and to be cut in when they become so old as to produce smaller fruit than is desirable.

Pruning.— The object of this is to admit the light and air among the branches, to preserve the symmetry of the head by causing it to spread equally and in the same form and manner on every side, and to eradicate diseased branches. (See chapter on GRAFTING, BUDDING, PRUNING, &c.,

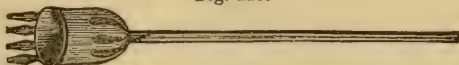
Fig. 118.



Gathering and Keeping.— The common mode of keeping, by those who grow apples in large quantities for the market, is to lay them in heaps in

cool dry cellars, and cover them with abundance of straw. They may be kept in a cellar, packed in barrels, the interstices filled with dry sand, so as

Fig. 119.



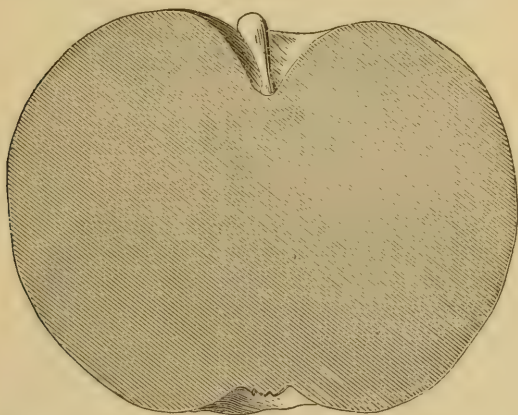
to exclude the air. Table apples may be spread upon shelves, or packed in sand, fern, or straw, in jars.

VARIETIES.

Summer Apples.

Early Harvest. — This is one of the earliest varieties worthy of cultivation; its form is flat, medium size, bright straw-colored skin, flesh tender

Fig. 120.



and sprightly. In the Middle and Western States it grows well, and is much esteemed. Ripens in July and August.

Red Astrachan. — This is a fruit of extraordinary beauty. It bears abundantly, the fruit being rather above the middle size, and very smooth and fair, roundish, a little narrowed towards the eye. The prevailing color is deep crimson, with sometimes a little greenish yellow in the shade, and occasionally a little russet near the stalk, and covered with a pale white bloom. Stalk rather short, and deeply inserted. Flesh white, crisp, moderately juicy, of a rich, acid, agreeable flavor. Ripe in August, and does not keep a long time after gathering. Hardy, vigorous, and productive. Adapted to various soils and climates. Fig. 121.

Fig. 121.

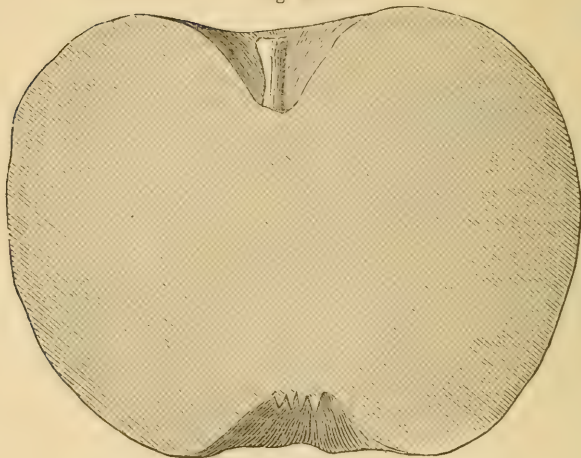
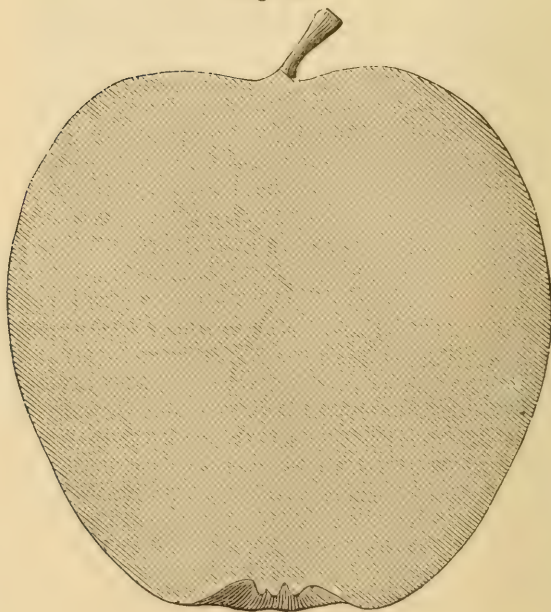


Fig. 122.



Williams's Favorite. — This is a moderate grower and a good bearer, requiring a strong soil to perfect it. It is large and handsome, and ripens from the last of July to the first of September. Skin very smooth, nearly covered with a fine dark red. Flesh yellowish-white, of mild and agreeable flavor. Fig. 122.

Fig. 123.

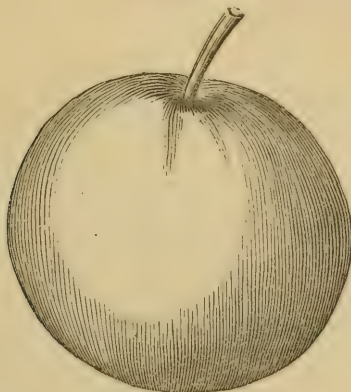
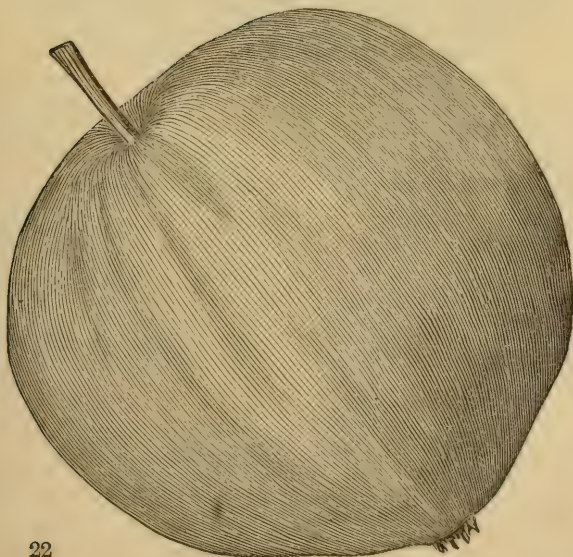


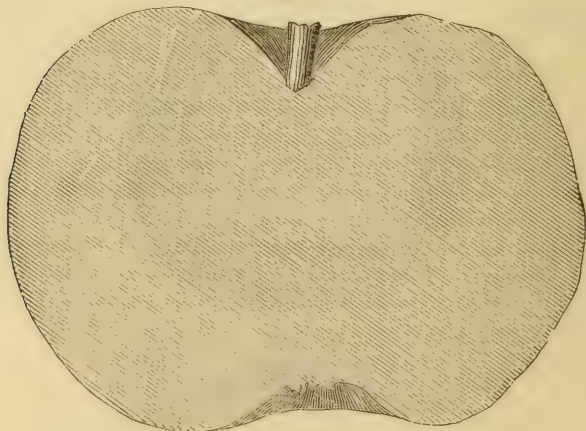
Fig. 124.



Juncating. — This is an old, favorite variety, of small size, **flat form**, long and thin stalk; color a pale green, turning to light yellow when ripe; the skin has an oily feel; the taste is pleasant. Bears abundantly in good ground, ripening from the last of June to the middle of July. Fig. 123.

Summer Queen. — A popular apple, of the finest quality and appearance. Large size; color fine, rich, yellow ground, mixed with red striped, long stalk; large tree; great bearer; flesh rich, yellow, and agreeable flavor. Best on sandy soil. Fig. 124.

Fig. 125.



Maiden's Blush. — An apple of large size and great beauty; has a yellow ground, bright red cheek; form flat; smooth skin; flesh white, tender, and sprightly; ripens in August, hardy, and great bearer. Fig. 125.

REMARKS. — The above comprise some of the most universally esteemed *Summer* apples; to which may be added the following well-established sorts, out of hundreds contained in the nursery catalogues: — *American Summer Pearmain*, a staple sort in New Jersey; *Benoni*; *Cole*, large and handsome; *Early Red Margaret*, a capital fruit, ripe in July; *Early Strawberry*, much esteemed in New York; *Large Yellow Bough*, a fine dessert fruit, *Summer Rose*, dessert; *Sapson*; *Tucker*; *Manomet Sweeting*; *Spice Sweet*; *Red Quarrenden*.

Fall Apples.

Porter. — A large and popular variety, very productive; skin bright yellow, with a blush; flesh fine-grained and juicy; ripens last of September to October.

Fall Pippin. — A fine kind, quite popular in the Middle States. Large size; round; skin smooth, oily, bright greenish-yellow, slightly speckled; flesh white, tender, juicy, of a superior flavor. Ripens from last of October to December.

Gravenstein. — Vigorous tree, and very productive. Fruit large; color clear straw or yellow, with stripes of red; flesh pale yellow, crisp, delicious

Fig. 126.

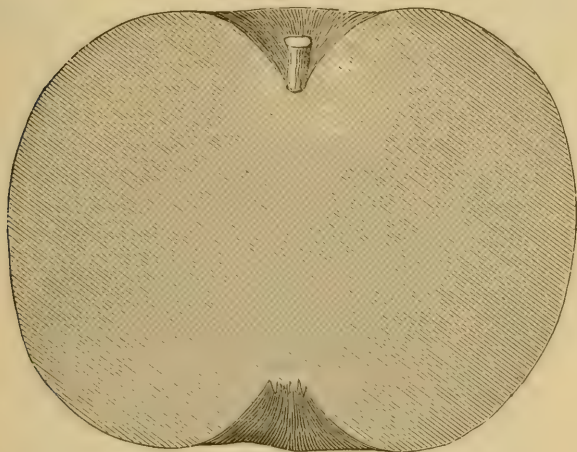
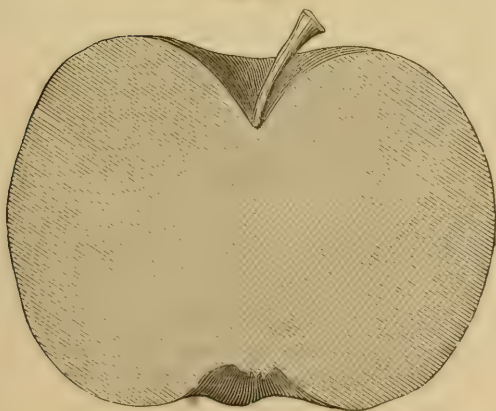


Fig. 127.

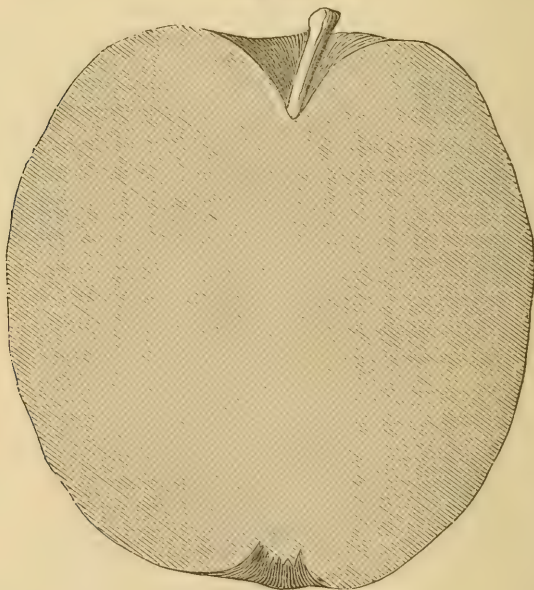


flavor. A fine fruit for dessert, cooking, or cider; ripe in September and October. Fig. 126.

Rambo.— Sometimes called *Gilpin*, *Romanite*, *Bread and Cheese*, and *Seek-no-further*. Popular in Middle States. Does well on a light sandy soil. Size not large; flat; skin smooth; color variegated. flesh greenish-white, tender, rich, slightly acid. Productive, ripening last of October to late in the season. Fig. 127.

Yellow Bellflower.— A much-admired fruit, rather preferring a sandy soil. Fruit large, oblong; skin smooth; color pale yellow, with a blush flesh juicy, tender, sub-acid. A good bearer, ripening in November.

Fig. 128.

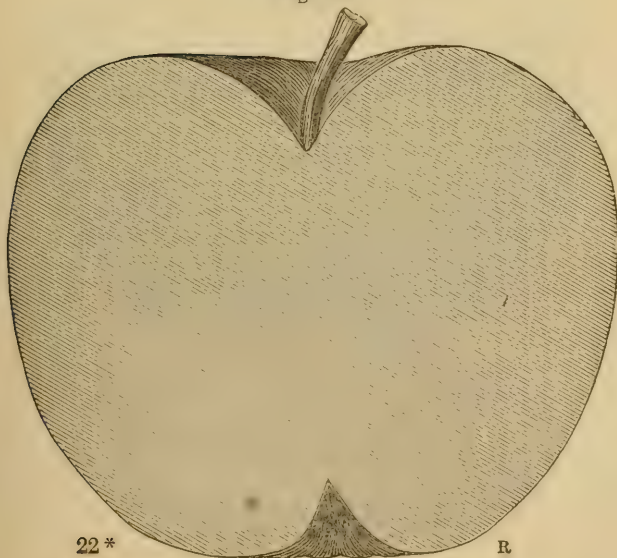


REMARKS.— The five preceding varieties are among the choicest *Fall* apples. There are others of nearly equal value, such as the *Golden Sweet*; *Richardson*; *Summer Bellflower*, of New York; *Bars*, of Rhode Island; *Lyman's Large Summer*, of Connecticut; *Winthrop Greening*, of Maine; *Early Joe*, of New York; *Mexico*, of Connecticut; *Superb Sweet*, of Massachusetts; *Fairbanks*; *Sassafras*, or *Haskell Sweet*; *Fall Wine*; *Lowell*; *Moses Wood*; *Jersey Sweeting*; *Leland Pippin*; *Pomme Royal*, of Ohio;

Fig. 129.



Fig. 130.



Lyscom; Magnolia; Thompkins, Jewett's Red, Fameuse; Golden Ball; Hurlbut, Belmont; Herefordshire Pearmain.

Winter and Spring Apples.

Esopus Spitzenberg. — This apple possesses great beauty and exquisite flavor. Large size; skin fair and smooth; color bright red, with small spots; flesh yellow, rich, juicy, and sprightly; good bearer. Fig. 129.

Baldwin. — Also called *Pecker*, and *Steele's Red Winter*. Ranks very high in the northern markets. Fruit large, roundish; color yellow and dull red, streaked and dotted; flesh pale-white, crisp, highly flavored. Good bearer, ripening from November to April. Fig. 130.

Hubbardston Nonsuch. — A superior variety. The tree grows large, vigorous, and handsome; bears abundantly. Fruit large, globular, or conical;

Fig. 131.



cal; color yellow, with stripes of pale red, flesh yellow, juicy, rich, sweet, relieved by a slight acid. Ripens in November and December.

Westfield Seck-no-further. — Same as the *Seck-no-further* of Connecticut — an old and valued fruit. Size large; round; color pale red and green, with slightly yellow dots; flesh white, tender, and rich. Fig. 132.

Newtown Pippin. — The *Green* and the *Yellow* are two distinct varieties of this apple. It grows well in the Middle and Western States. Size medium; flesh fine, firm, crisp, juicy, very superior flavor.

Fig. 132.

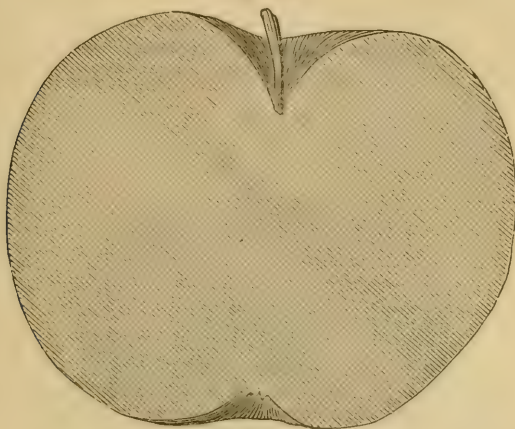
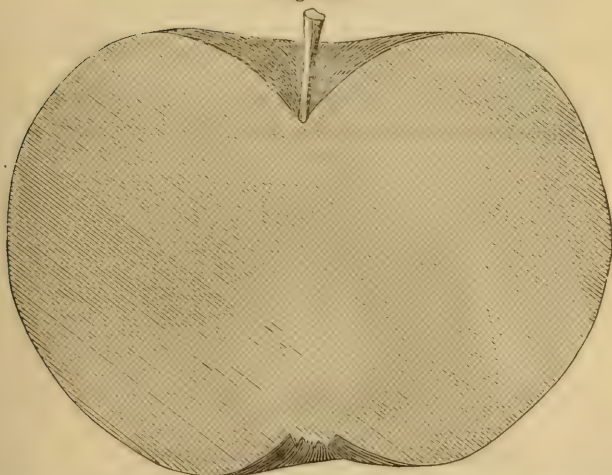


Fig. 133.



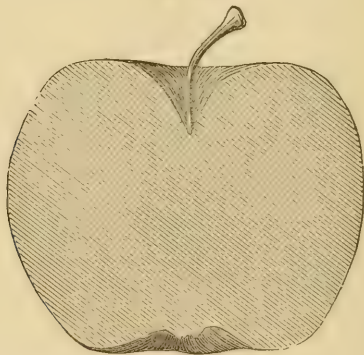
Roxbury Russet. — Very popular, and extensively grown. Medium size,

roundish, somewhat flat; skin dull green or brownish-yellow; flesh greenish white, compact, slightly acid, but rich flavored. Ripe in Dec. Fig. 133.

Rhode Island Greening. — Also called *Jersey*; and *Burlington Greening*. A very large fruit, flat at its base and summit; color yellowish-green, with dark spots; flesh yellow, tender; rich, juicy, acid flavor; ripens from September to March; bears abundantly. A universal favorite.

Golden Pippin. — Beautiful dessert apple. Small, round, symmetrical; gold color, with dark dots; flesh yellowish; rich, sprightly flavor; great

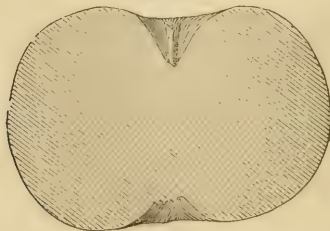
Fig. 134.



bearer, flourishing best on a strong sandy loam. Ripens November to March.

Lady Apple. — Superior for the table. Fruit small, but beautiful; rather flat; skin smooth; color yellow and red; flesh firm, white, well flavored.

Fig. 135.



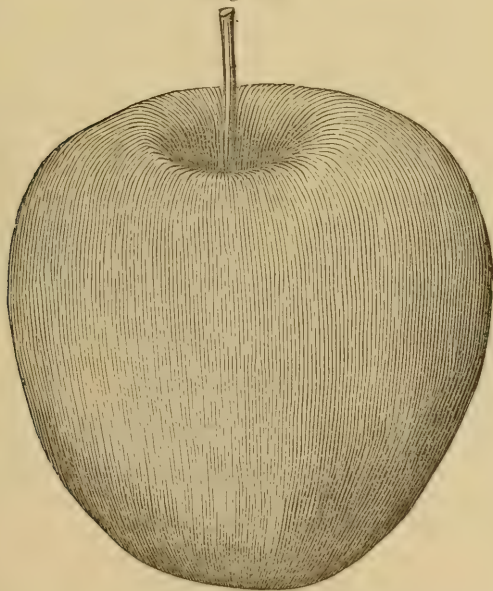
REMARKS. — It would be easy to extend the foregoing list of *Winter* and *Spring* apples, had we the room requisite. We have described the most desirable standard sorts for cultivation in this country, and subjoin the

names of other varieties of note: *Detroit*; *Northern Spy*; *Blue Pearmain*; *Peck's Pleasant*; *Swaar*; *Waxen Apple*; *King*; *Gloria Mundi*; *Norton's Melon*; *Golden Reinette*; *Hollow Crown Pearmain*; *Ladies' Sweeting*; *Danvers Winter Sweeting*; *Fort Miami*; *Wood's Greening*; *Vandevere*; *Jonathan*; *Minister*; *Old Nonsuch*; *Prior's Red*; *Leicester Sweeting*; *Tolman Sweeting*; *American Golden Russet*; *Little Pearmain*; *Tewksbury Winter Blush*; *Raule's Janette*; *Rockrimmon*; *Never Fail*.

Cider Apples.

The most valuable kinds for the manufacture of cider are the *Harrison* (Fig. 136) and *Camfield*, extensively raised in the Middle States, being rich

Fig. 136.



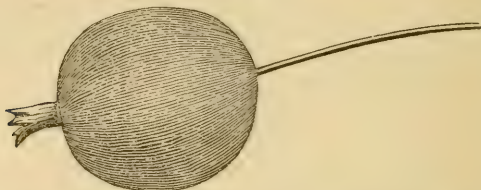
in flavor, and bearing very abundantly; *Hugh's Virginia Crab*, small size, but very productive; and the *Red Streak*.

Crab Apples.

Red Siberian. — A beautiful tree, and a great bearer. Fruit small, about the size of a cherry, growing in clusters; color bright red, when matured;

globular form, long and thin stem. Excellent for preserves. Ripe in September.

Fig. 137.



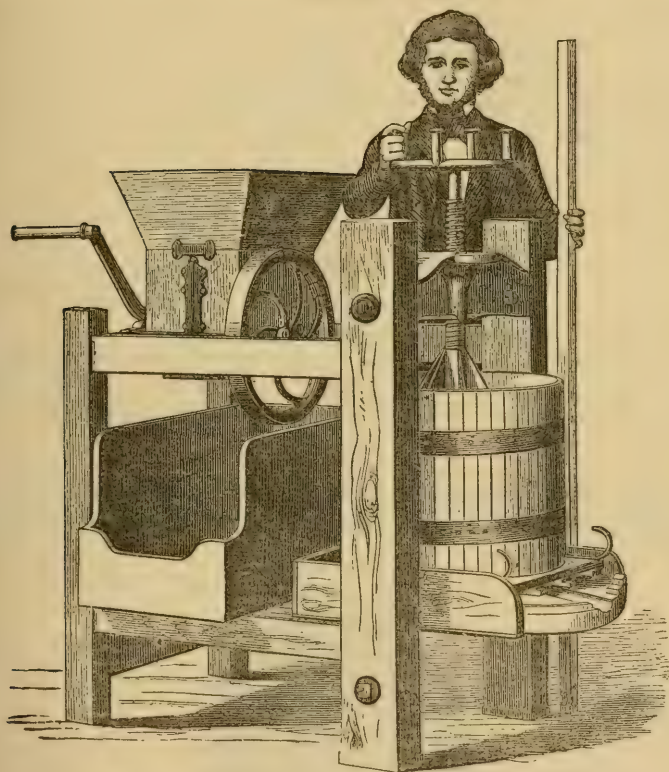
Yellow Siberian.—The tree, its habits and appearance—excepting the color of the fruit—is similar to the preceding. The color of the fruit is a fine, clear yellow, or a rich golden hue. Ripe in September and October.

MAKING CIDER.—In order to make good cider, sound fruit only must be used, and this should be gathered in dry weather, if possible, after the first of October. Let the fruit lay in heaps for some days to sweat and ripen; but be careful not to grind it while damp, and remember that the finer the apples are ground, not only will the yield be greater, but the quality of the cider will also be proportionally improved. A well-fitted mill will crush the seed also, thus imparting a peculiar aromatic-bitter taste to the must, which becomes stronger as the cider obtains age. The pomace may be allowed to stand from six to twenty-four hours after being ground, or it may be pressed at once, according as it is desired to give to the cider a pale or a high color. Figure 138 represents Hicock's patent portable cider-mill, by the use of which more work can be done than can be effected with much larger stationary mills.

Fermentation of the Juice.—Cider is capable of three different kinds of fermentation: the *vinous*, which originates the alcohol that imparts to the liquor its stimulating and exhilarating qualities; the *acid*, which changes the cider into vinegar; and the *putrid*, which destroys it entirely, by converting it into a nauseous and poisonous liquid. The principal object aimed at in making cider being to stop the fermentation when it has progressed to the vinous stage, and before it takes on the acid character, the fermentation should be slow, and the temperature of the apartment never exceed 48° Fahrenheit. To secure this object, pour the liquor, after being strained, into large hogsheads, placed on a platform raised about six feet from the floor. A faucet should be inserted at the bottom of each hogshead, by which, when the fermentation has ceased, and the liquor has become clear, it may be drawn off at once into barrels without coming in contact with the atmospheric air, which produces the acetous

fermentation. Experienced cider-makers in England say that the acid fermentation is progressing at the same time with the vinous, and that the liquor is, from the commencement, absorbing oxygen at the surface.

Fig. 138.



To check this, it is recommended to add pulverized charcoal to the liquor as it comes from the press, in the proportion of eight pounds to the hogs-head. This at first makes the liquor very black, but eventually it becomes remarkably fine.

Preparation of Casks.—As soon as emptied, the casks should be rinsed with cold water. If they become sour, and covered with acid seum, a pint of unslaked lime must be put into each cask, together with three or four gallons of water, the bung-hole closed, and the whole well shaken.

When cool, rinse them out with cold water, after which pour in about six gallons of scalding water, and when every part of the cask is heated, pour it off, and turn the cask bung down to dry. When dry, bung up the casks, and stow them away carefully for use the following year.

Fining and Bottling.—Cider should be bottled during the cold weather of winter. It may be clarified by adding to the contents of each cask one ounce of isinglass in solution, which must be well mixed with the cider, and in seven or eight days it will be ready for bottling. Cider should never stand on the finings more than ten or twelve days, and, when properly fined, it will be clear and transparent—otherwise it is not fit for bottling.

Vinegar.—The best cider vinegar may be made by adding to a cask of good cider four pounds of white Havana sugar and half a pound of tartar.

THE APRICOT.

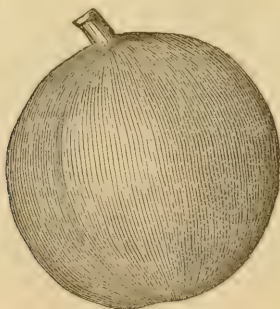
Propagation.—The apricot-tree may be raised from the stone, like the peach, or by budding, either on its own or plum stocks.

Soil and Situation.—The soil which suits the apricot best is a rich black mould, though some recommend a light loam. It thrives better in the Middle States than at the North, where, when propagated, it needs shelter.

VARIETIES.

Early Apricot.—This variety is round-shaped, little inclined to oblong, with a furrow running from the stem to the head; color bright yellow, with

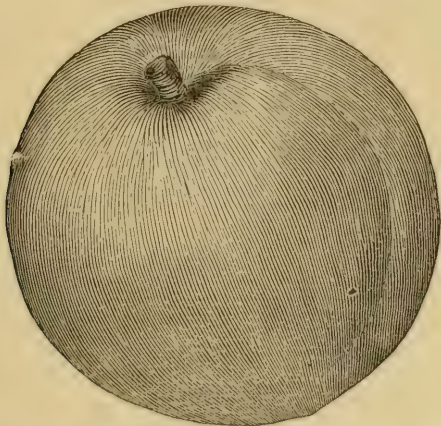
Fig. 139.



a red cheek; flesh yellowish white, rich, juicy, finely flavored. It ripens in the month of July, which is one of its chief merits.

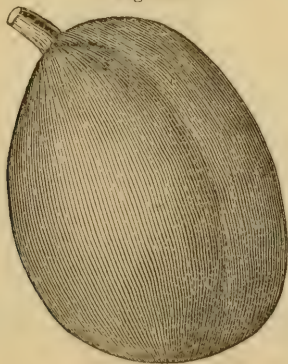
Large Early. — This is a fine fruit, which also ripens in July. The fruit is of medium size, somewhat oblong; color orange, rather pale; flesh straw-color, rich, juicy, easily leaving the stone. An excellent sort

Fig. 140.



Peach. — This is the largest, and by many considered the finest, of all the varieties. The form is round, with compressed sides; color a yellowish

Fig. 141.



fawn on the shady side, slightly colored with red towards the sun, flesh yellow, sprightly, juicy, and highly flavored. Ripens in August. Fig 140.

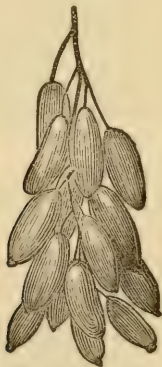
Brussels.—The most hardy tree, and, perhaps, the most certain, in our climate. It is large, long fruit; color a pale yellow, with a portion of red, and some spots; flesh a pale yellow, firm, rich, tender, and juicy; clear at the stone; does not grow mealy; ripens in July. Fig. 141.

REMARKS.—Of the other cultivated sorts, the *Moorpark* and *Red Masculine* are the most valuable and popular; besides these, there are the *Breda*; *Black*; *Roman*—good for the North; *White Masculine*; *Turkey*. There are also varieties exclusively ornamental.

THE BARBERRY.

Culture, &c.—But little may be said respecting this well-known shrub, which grows spontaneously in this country and in Europe, bearing a small acid berry, much used as a pickle and preserve. It is readily propagated by seeds and suckers, in a light, rich soil.

Fig. 142.



VARIETIES.

Common Red.—This is the variety most known, and its appearance and habits are too familiar to require any description here. Its color, when fully ripe, is a deep scarlet, with a slightly dark tinge.

THE BLACKBERRY.

Although the Blackberry grows plentifully in its wild state, yet it is now largely cultivated, either by planting the seed in rich soil, and manuring freely, or by setting out layers.

VARIETIES

The *Kittatinny*, *Lawton* and *Wilson*, are all choice kinds.

Fig. 143.



Trailing.—This variety is produced on a low shrub, with trailing branches. The fruit is large, roundish-oblong, and ripens in July. The best for all purposes.

High.—This is an erect shrub, growing to the height of eight or ten feet. The fruit (Fig. 143) is generally somewhat smaller than the *Trailing*, and, though highly esteemed, is not so rich and highly flavored as the first-named. Sometimes raised in gardens.

White.—Not much known—has white fruit.

Double White Flowering, and Double Pink Flowering.—These are ornamental varieties, growing very luxuriantly, and making a splendid appearance when trained on walls and fences. Not so common in the Northern States as elsewhere.

THE CHERRY.

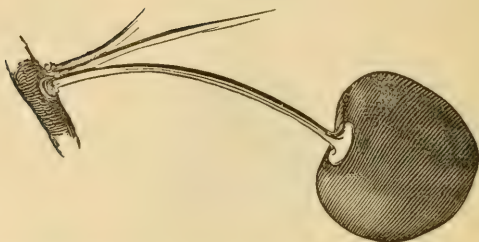
Propagation.—The Cherry-tree is propagated by seeds and by suckers, when stems are wanted ; by seeds alone, when new varieties are wanted ; by scions, when working on old subjects ; and by buds, when the trees are young. If intended for dwarfs, bud the plants at two, and if for standards, at four, years of age. The spring succeeding this operation is the time for transplanting.

Soil and Situation.—This tree will grow and thrive in a diversity of soils, but prefers a deep loam, in a free exposure. A wet soil is not adapted for its healthy growth and bearing ; neither should the soil be too rich, as it will then become thrifty in wood, without corresponding fruitfulness.

VARIETIES.

Black Heart—also known as *Early Black, New May Duke, Ansell's Fine Black, Spanish Black Heart, Black Russian, and Black Caroon*—

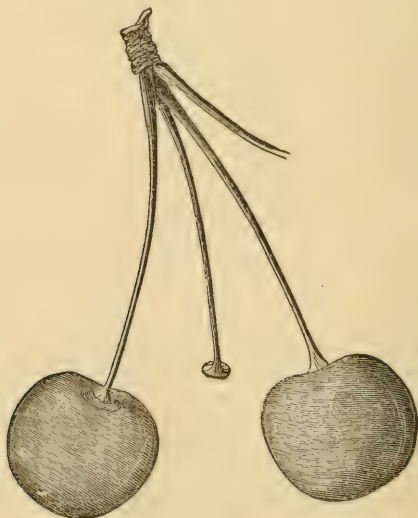
Fig. 144.



is an old and esteemed variety : fruit large, heart-shaped ; color dark purple to deep black ; flesh tender, juicy, sweet, well-flavored. Ripens last of June.

May Duke—also known as *Early Duke*, *Holman's Duke*, and *June Duke*—is one of the choicest and most thrifty sorts, and very extensively cultivated. The fruit is roundish, growing in clusters ; color red ; flesh soft and juicy, rich, and of fine flavor. Ripens in June.

Fig. 145.



Bigarreau.—*Yellow Spanish*, *White Bigarreau*, *White Tartarean*, by some. Size large to very large, heart-shaped and flattened ; color pale

yellow, or straw, slightly dotted; flesh yellowish tinge, firm, juicy, and sweet. Ripens towards the last of June, and is a superior sort.

American Amber.—*Early Amber*, and *New Honey*, by some. Fruit medium size, growing in clusters of three or more; color dark pink, when ripe; flesh rich, sweet, amber color. Ripe in June. Fig. 145.

Elton.—Size quite large, and heart-shaped; tree hardy, with dark red footstalks to the leaves; skin rather thin; color somewhat variegated, with pale straw and red in streaks; flesh firm, juicy, and sweet; ripens in June, and bears abundantly. Much esteemed.

Black Eagle.—A foreign sort, very popular in some parts; size about medium; heart-shaped, somewhat globular; color purplish-black; flesh tender, juicy, and well-flavored. Ripens in July.

Ox Heart.—A long, large, heart-shaped cherry, with a dark red skin; flesh rich, firm, with a fair flavor. Ripens early in July.

Black Tartarean.—Also known as *Black Russian*, *Ronald's Large Black Heart*, and *Black Circassian*. A large and superior fruit; heart-shaped; color blackish-purple; flesh dark, firm, sweet, excellent flavor. Fine bearer, and is ripe about the first of July.

Downer's Late.—Fruit large size, oval. Skin smooth, light red; flesh firm, juicy, sweet, and delicious; ripe in early part of July, lasting a considerable time. Certain and productive bearer.

Fig. 146.



Early White Heart.—A very early sort, ripening near the end of May. Size rather small, and oblong heart-shaped; skin waxy white, tinged with

Fig. 147.



a pale red; flesh firm, sweet, and finely flavored. not so productive as the May Duke, and some others

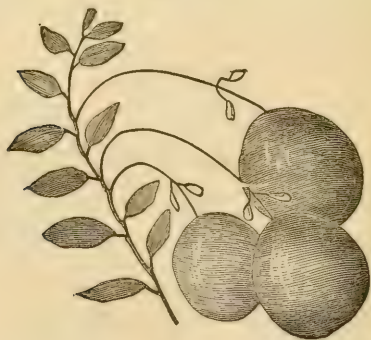
REMARKS.—The other established and standard sorts are the *Doctor*, *Belle de Choisy*, *Napolcon Bigarreau*, *White Tartarean*, *Norello*, *Knight's Early Black*, *Florence*, *Downton*, *Manning's Mottled*, *Holland Bigarreau*, *Elliott's Favorite*, *Hyde's Seedling*, and *Kentish*.

THE WILD CHERRY comprises several varieties, and the best kind being the *Black*, which is ripe in September or October, and is used for various medicinal purposes. The *Choke Cherry* is another kind, bearing a red berry, which matures earlier than the first-named.

THE CRANBERRY.

General Cultrue, &c.—Comparatively speaking, the cultivation of the cranberry has now been reduced to a very certain and well-defined system. It is a native fruit, growing on a low trailing vine, found in bogs, meadows, swamps, and other wet lands. The berry is round, red, and quite acid, the finest variety being found in this country, where it commands a high price.

Fig. 148

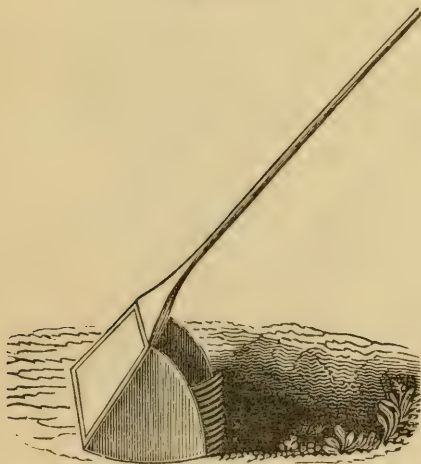


Some persons enumerate three kinds, only one of which, often called the *Bell*, is adapted to a dry soil. It grows wild, on the borders of bogs, spreading its way to upland soils, and is much larger than the other kinds, in its wild state. Persons engaging in the cultivation of this fruit may begin with the *Bell*; by commencing with those which have been cultivated, or naturalized to a dry soil, they will much sooner

accomplish their object, and with much less trouble and expense, as the plants multiply and increase abundantly. From one or two thousand plants, enough may be obtained, in two or three years, to plant a very large surface of ground.

Select a moist soil, not liable to bake ; loamy soils, which are moderately dry, and contain a mixture of sand, are well adapted for the purpose. The soil should be prepared by ploughing, harrowing, and making it even, and should be marked out in drills eighteen or twenty inches apart, putting the plants in the drills about six inches apart ; hoe them slightly, till the roots become clinched, when further cultivation is unnecessary. In two or three years the plants may be expected to run together and cover the whole soil. It will yield from one hundred and fifty to four hundred bushels per acre, the size being two or three times as large as the wild, and of a superior flavor, and keeps sound from the harvest of one year to that of the next. The fruit is generally gathered in September, with wire-tooth rakes made

Fig. 149.



for the purpose (Fig. 149). One man may gather from thirty to forty bushels per day, with the aid of a boy to pick up the scattered fruit.

The roots may be planted either in spring or fall ; the former from the time when the ground can be worked till the middle of May, and the latter in October and November.

In some places, low and coarse meadows, of no value, have been drained and planted with the cranberry, and are thus made very profitable. After

draining the land well, and removing all brush and shrubs, the soil is ploughed, though it is usually sufficient to cover the surface with a heavy top-dressing of sandy soil, and then make holes four feet apart, into which the sods, or square bunches of the cranberry-roots, are planted. Some cranberry-growers think it expedient to flow such lands, the water being let on about the 20th of October, and remain till the 20th of May, or till the frosts have disappeared, in order that the blossoms may not be cut off in the spring, by appearing too early.

To keep Cranberries.—When the fruit is to be exported, it is put, in a perfect state, into tight barrels, filled with water, and headed up, by which means they are kept sound and good.

Fig. 150.



THE CURRANT.

Propagation.—The best method of propagation is by cuttings,—the

shoots of the last summer's production, of straight, clean growth, shortening each from about ten to twelve or fifteen inches long, according to its strength.

Plant in rows about two feet asunder, and about nine inches apart in the rows; let no limbs grow nearer than six inches to the ground; prune every year, giving free access to the sun. To cultivate on an extensive scale, set

Fig. 151.



the bushes in rows, six or eight feet between each bush, with intervals of proper width for passing across the rows.

Soil and Situation. — A strong, rich, deep loam brings the fruit to its highest state of perfection, but it will thrive in a much poorer soil.

VARIETIES.

Red Dutch, — also known as *Morgan's Red*, and *Red Grape*, — is a large-sized currant; color red; rather mild flavor; grows in long clusters.

White Dutch. — *White Leghorn*, *White Crystal*, *Morgan's White*, *Reeve's White*, by some. Size large; skin slightly yellowish; flavor mild; quite hardy. A variety much esteemed for the dessert. Fig. 150.

Black Naples. — This is considered the best of the black varieties, being larger and more prolific. It is not so well suited to a southern clime.

Champagne. — A pale-red fruit, large, and quite acid. Not of superior quality.

May's Victoria. — This is a newly-introduced sort, bearing a large berry, of a brilliant red color. The flavor is very superior, and the bush is very productive. By many persons it is esteemed the best of all the colored kinds. Fig. 151.

REMARKS. — The other notable varieties are *Knight's Early Red*, *Common Black*, and *Striped Fruited*. The varieties described above are, however, the best.

THE GOOSEBERRY.

Propagation. — The mode by cuttings is usually adopted for continuing varieties, and that by seeds for procuring new ones. Plant the cuttings in autumn.

Soil and Situation. — Any good garden-soil, on a dry bottom and well manured, will suit the gooseberry; that which is soft and moist producing the largest fruit. The situation should not be under the drip of trees overmuch shaded or confined, otherwise the fruit will be small, ill-flavored, and the plants apt to mildew. Keep well pruned.

VARIETIES.

Capper's Top Sawyer. — A large, round, hairy fruit; branches somewhat drooping; ripens somewhat late; considered very fine.

Melling's Crown Bob. — Berry of large size, oblong, bright red, hairy, good flavor, rather late. It is highly recommended by growers, as an excellent sort, and profitable to cultivate in gardens or elsewhere. Fig. 152.

Fig. 152.



Houghton's Seedling. — This variety is said not to mildew under any circumstances. It grows very thrifty, and bears abundantly, though the

Fig. 153.



berry is not so large size as some others ; flesh soft and sweet ; skin delicate ; color dark. A very superior sort, if not the very best. Fig. 153.

Woodward's Whitesmith. — Large, white, roundish, erect branches, fine flavor ; considered an excellent kind.

Coleworth's White Lion. — White, roundish-oblong, downy ; ripens late ; excellent flavor, branches drooping, good bearer.

Crompton's Sheba Queen. — Fruit good size, rather early ; form roundish-oblong ; downy ; good flavor.

Early Green Hairy. — Fruit small, round, and hairy ; deep green ; flavor excellent ; ripens quite early.

Red Warrington. — Fruit large and roundish ; excellent flavor.

REMARKS. — *Farrow's Roaring Lion*, *Parkinson's Laurel*, *Keene's Seedling*, *Early Sulphur*, *Yellow Ball*, *Early White*, *White Honey*, *Pitmaston Green Gage*, *Old Rough Red*, *Hill's Golden Gourd*, *Prophet's Rockwood*, *Nixon's Green Myrtle*, and *Wellington's Glory*, are also well-known sorts.

THE GRAPE.

Propagation. — Vines are propagated in the open ground by layers and by cuttings. The former is the readier mode, if the shoots be laid down in pots, and planted out in summer. The latter mode is much the better. To provide cuttings to be planted at the proper season, select, at the autumnal pruning, a sufficient number of shoots of the preceding summer's growth, such as are well ripened, of a medium size, and moderately short-jointed. Cut them into convenient lengths of six or eight buds each, leaving at the ends not less than a couple of inches of the blank wood for the protection of the terminal buds. Stick these temporary cuttings about nine inches in the ground, in a warm and sheltered situation, where they will be protected from the severity of winter. The best time to plant them out is about the last of March, or fore part of April.

Soil and Situation. — A light, porous, rich, sandy loam, not more than eighteen inches deep, on a dry bottom of gravel, stones or rocks, is the best. The warmer the aspect, the greater perfection does the grape usually attain. Warmth alone is not, however, sufficient; shelter from the withering influence of the wind is equally necessary.

Culture, &c. — Manure composed of bones, whole or crushed, the horns and hoofs of animals, as well as their carcasses, cuttings of leather, woollen rags, feathers, hair, urine, blood, — indeed, almost every variety of manure may be used to fertilize and enrich the soil occupied by the vine. If very rich manures are used, they should be mixed with turf and sand, otherwise so much benefit does not accrue.

Pruning. — In pruning the vine, always cut upwards, and in a sloping direction; always leave an inch of blank wood between the terminal bud, and let the eye be cut on the opposite side of the bud; leave as few wounds as possible, and let the surface of every cut be perfectly smooth. In cutting out an old branch, prune it even with the parent limb, that the wound may heal quickly; prune so as to obtain the quantity of fruit desired on the smallest number of shoots possible; never prune in frosty weather, nor when frost is expected; never prune in the spring, as this causes bleeding, and therefore a wasteful and injurious flow of sap; prune as soon after the first of October as the gathering of the fruit will permit.

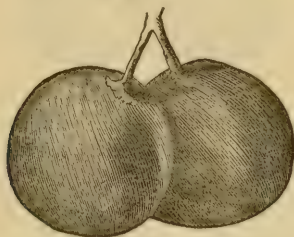
Training. — To train a vine on the surface of a wall is to regulate the position of its branches, the principal objects of which are, to protect them from the influence of the wind; to bring them into close contact with the wall, for the purpose of receiving the benefit of its warmth; to spread them at proper distances from each other, that the foliage and fruit may receive the full effects of the sun's rays; and to retard the motion of the sap, so as to

secure the formation of fruit-buds. The flow of sap, it must be remembered, is always strongest in a vertical direction, and weakest in a downward one; on this account, serpentine training is preferable, being calculated to check the too rapid ascent of the sap, and to make it flow more equally into the fruiting-shoots, and those intended for future bearers.

VARIETIES.

Black Hamburgh.—A well-known variety, but more adapted to the vinery than for out-of-door culture. The bunches are quite large size; berries

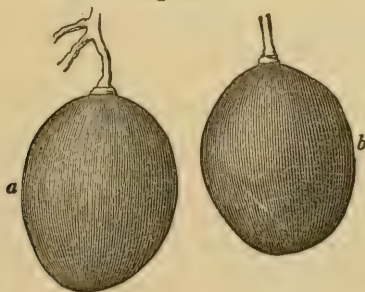
Fig. 154.



large, roundish, slightly oval; skin thick, deep purple or nearly black; flavor rich and sweet. A productive and valuable sort.

Miller's Burgundy.—A very hardy and fruitful grape, very popular, and extensively grown. Its leaves are very thick, covered on both sides with a thick down. The bunches are small, but solid; skin thick, of a blue-black color; flesh tender, juicy, and pleasant.

Fig. 155.



Muscat of Alexandria.—There are the *White* and the *Red* Muscat, the former (a) being large in the berry, of oval size, and fruiting in long, large

bunches ; the skin is thick ; flesh firm, juicy, musky flavor, very agreeable eating ; hangs a long time on the branches. The Red resembles the White, except in color (*b*). Ripens finely on walls. Fig. 155.

Catawba. — This is a native sort, highly esteemed. It is hardy, vigorous, and productive ; large bunches ; color deep purple and palish-red ; thick

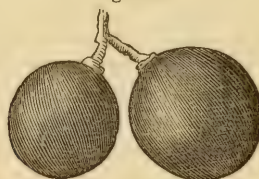
Fig. 156.



skin ; pulp sweet, rich, finely flavored. Ripens first part of October. Superior for wine, or eating, and succeeds well in any tolerably fair situation.

Isabella. — A hardy plant, very productive, and, in this country, almost universally grown. Bunches large, rather loose ; berries fair size, oval ;

Fig. 157.



skin thick, purplish black ; flesh soft to firm, juicy, sweet, aromatic. A most valuable variety, rather late at the North, but seasonable in the Middle and Western States.

Alexander. — Known also as the *Schuylkill Muscadel*. A certain and prolific bearer ; large, bluish-black berry ; oval ; skin thick ; flesh firm, sweet, musky flavor. Not so thrifty at the North as the two previous sorts.

Scuppernong. — Distinguished by its diminutive leaves ; grows wild in some parts of the United States, and is in considerable use as a wine fruit, for which purpose it is esteemed one of the best. The *White* and the *Black* are scarcely dissimilar in any particular, except their respective colors. The bunches are rather small ; berries large, pretty round ; thick skin ; flesh sweet and juicy, with a musky taste and flavor.

REMARKS. — There are numerous other varieties worthy of an extended

notice, on account of their peculiar adaptedness to particular sections, and their distinctive uses, such as the *Royal Muscadine*, *Early Black July*, *Black Prince*, *Bland*, *Ohio*, *Lenoir*, *Diana*, *Winnie*, *Clinton*, *Cunningham*, *Warren's Madeira*, *Elsinburgh*, *Norton's Virginia*, *White Sweetwater*, *Black Sweetwater*, *Black*, *Grizzly*, *White Frontignan*, and *Missouri*.

VINEYARDS. — The making of wine having now become an important branch of agricultural industry, a short sketch of the mode of laying out and cultivating a vineyard, gathering the grapes, making and fining the wines, etc. may not be here out of place. The best preparation for

Fig. 158.



a vineyard is to dig the ground up to the depth of three feet during the autumn previous to planting the vines. In spring lay it off into hills distant from each other six feet in one direction, and five feet in the other, and in each hill plant two cuttings, to guard against the possibility of one failing to grow. If both cuttings sprout, one of them may either be cut off, or transplanted.

Culture. — During the *first* year the labors of the vine-dresser are confined to hoeing the ground, and removing the weeds, as well as all superfluous shoots. The following spring the young vines are cut down to a

single eye or joint, and trained to stakes, which are made of locust or oak, and six or seven feet in length. One of these is driven into the earth close to each vine, which is fastened to it with a wisp of straw. All the suckers are trimmed off, and the ground kept clear and well loosened. The *second* spring after planting the vines are cut down to three eyes or joints, but the general cultivation is the same as during the first year. If any of the sets have not taken root, they are replaced by new ones. The *third* year the vines are cut down to four or five joints, all the suckers trimmed off, the vines tied up, and hoed thoroughly. Two shoots are trained to each stake. The vines commence to bear during the third year, and thereafter are pruned and trained every year, during the month of December. The standard stalk is established during the fourth year, by cutting down the best shoot of the preceding year to six or eight joints, bending it over in the form of a bow, and fastening it to the stake with willow ties. This is called the bearing-wood. The other shoot is cut down to a spur of two or three eyes, and forms a reserve of bearing-wood for the following season. Each succeeding year the old bearing-wood is pruned away, and a new arch formed with the best shoot of the new wood — a spur being left, as before, to furnish bearing-wood for the next year. The original stalk being thus always kept about two feet high, the vine is always within control; and, as the vines extend, they are trained from stake to stake, until the fruit has nearly ripened, when the green ends are excised. During each summer the ground is hoed two or three times, and kept scrupulously clean; and every third year the land is trenched, and two or three inches of well-rotted manure turned in.

Pressing the Grapes.—The grapes are never gathered until the saccharine principle is fully developed. This fact is ascertained by testing some of the juice with a saccharometer. An ordinary portable cider-mill answers very well for small crops; but where grapes are extensively grown, a press adapted to this use is usually supplied. The grapes are well pressed, to extract all the juice; for that which flows first contains but little *mucose-saccharine* matter, without which the liquor does not ferment freely. That substance is chiefly present in the insoluble, organized parts and the skins, which also contain most of the acid, the resinous extractive, and the coloring principle. Some growers let the mashed grapes stand for twenty-four hours in open hogsheads, and do not press them until they ferment, and the grapes rise to the surface of the liquor. A slight fermentation in the skins is said to improve the color and aroma of the wine; but too protracted fermentation is regarded as injurious, by giving it a bitter, astringent taste.

Making Wine.—After the grapes are pressed, and the juice or *must*

extracted, the latter is exposed to a temperature of 65° Fahr., when fermentation commences. The liquor is agitated by an intestine motion, and bubbles are evolved, which buoy up the grosser matter, increase the bulk of the mass, and form a scum upon the surface. An increase of temperature then takes place, and the must, losing its saccharine taste, acquires a deeper color than before, together with a vinous flavor, which increases with the progress of the fermentation. When the fermentation has subsided, which generally occurs in a few days, the mass returns to its original bulk, the scum sinks to the bottom of the vessel, the liquor becomes transparent, and is changed into wine. The constitution of the must is liable to be greatly influenced by the culture of the grapes, their variety and quality, and by the peculiarities of the climate in which they are grown, as well as by the nature of the season. A cold year so much diminishes the yield of saccharine matter, as to render the wine weak, harsh, and ascendent; and a wet season diminishes the quantity of alcohol. High winds and fogs are also injurious. When the wine has settled, it is drawn off into casks, in which it undergoes further changes. It is then racked off into other casks, in which it is subjected to the operation of sulphurizing—sulphur matches being burned in the casks, to render the glutinous matter incapable of re-exciting fermentation. The wine is then fined; that is, deprived of those matters which render it turbid, and dispose it to changes of a deteriorating nature. Either isinglass or white of egg is used for this purpose. The first unites with the tannic acid in the wine, and the second with the alcohol, forming reticulated coagula, which envelop and throw down those solid particles which endanger the safety of the wine. When the wine again clears, it is ready for use, or for bottling, which is the best mode of keeping it. The bottles are corked tight, covered with sealing-wax, and laid on their sides in tiers. If sparkling wines are desired, the old and new vintages are mixed together in equal proportions. The cold weather of the winter months are best suited for fining wines, as at that time they deposit most of the matter previously held in suspension. Wines left in the wood are liable to become sour by alternations of temperature.

Champagne Wine.—The following is the process for making this highly-prized wine. After being pressed out the juice is allowed to ferment in casks for a few days. When fermentation ceases the wine has a rapid and disagreeable taste. It is then fined to as great a degree of brightness as can be secured before the commencement of the bottling season, which is usually in March. After bottling, a second fermentation is induced by putting into each bottle a small glassful of "liqueur" (sugar-candy dissolved in wine, and fined to brightness). However bright the

wine may be when bottled, this fermentation produces a fresh deposit of sediment, or lees. This process requires the greatest attention, the bottles being closely watched, and the temperature of the air regulated to the point necessary to check or promote fermentation. When the wine begins to deposit a sediment, the bottles are placed, necks downward, in long beds or shelves, pierced with oblique holes. Every day each bottle is raised, gently vibrated, and again replaced in a position slightly vertical. By this method the sediment is detached from the side of the bottle, and allowed to pass toward the neck. Finally the bottles are placed in an upright position, and the sediment, being then entirely deposited in the necks, is ready for "disgorging." To effect this purpose the bottles are held mouths downward before a recess, and the wires confining the corks cut, when the contained gases drive out the corks, and with them the foul sediment. The skill of the operator is evinced by his preserving all the pure wine, and parting with nothing but the foul liquor. The bottles are then refilled from wine previously purified, re-corked, and again stacked. When the wine is prepared for sale, a second disgorgement is always necessary, and sometimes a third. When ready, the wine gets another dose of "liqueur," composed of very pure candy dissolved in white wine for ordinary champagne, and red wine for the pink. This gives it an exquisite sweetness, and adds to its sparkling qualities when opened. The quantity put into each bottle depends on the market for which it is intended, but it is usually a good wineglassful.

Constituents of Wine.—These are: 1. *Odoriferous principle*, which is due to the presence of a volatile oil. 2. *Alcohol*. This exists in all wines: those containing it in small quantity are called light wines; the others are known as strong wines. 3. *Free Acids*. Wines contain malic, citric, and tartaric acids. The effervescent wines, such as champagne, which are bottled before fermentation is completed, owe their peculiar properties to the retention, and subsequent escape when the confining force is removed, of the developed carbonic acid gas. They are apt to become ropy, which is prevented by the addition of pure tannic acid, or nut-galls in powder. The tannic acid of some wines, especially that of the red wines, as port, is derived in great part from the husk of the grape, but partly from the seeds. 4. *Sugar*. This varies greatly in different wines; those containing it most abundantly being denominated sweet wines. 5. *Extractive*. This exists in all wines, but diminishes with age. 6. *Coloring matter*. When the husks are separated from the liquor before fermentation, the wine is pale, and is then called white wine; but when fermentation takes place before the removal of the husks, the wine acquires a dark hue, and is then known as red wine. The purple coloring matter,

which resides in the husks, is dissolved out by the newly-formed alcohol, and reddened by the free acid. 7. *Tartar*. This substance is deposited both in the cask and in the bottles, constituting *argol* and *crust*. The deposition increases with the formation of alcohol, and red wines contain a greater quantity than white wines.

THE MEDLAR.

Propagation. — It is raised by grafting, by layers, also by seed, planted while fresh, and in the fall. The seed does not germinate for some time; the layers will root in autumn: the pear is the best stock upon which to graft. Tree low; fruit round, size of a plum; pulp thick, with five stones.

Soil and Situation. — Any common soil will answer, but a well-drained, retentive loam, suits it best. Gather the fruit in November, and spread singly upon sand.

VARIETIES.

Blake's Large. — A variety not very frequent, though by some thought one of the best.

German or Dutch. — The tree is very irregular, dwarfed; fruit large, and, all things considered, the best of all the sorts.

Nottingham. — This is small-sized, and of a quick, pungent flavor.

Stoneless. — Not so good quality, but may be preserved better than the other kinds.

THE MELON.

Propagation, &c. — Propagated by seeds, planted in shallow hills, five or six feet apart each way. From six to ten seeds in a hill will suffice, and the soil which covers them should be about half an inch deep. When up, thin the plants to two or three in a hill, and draw the earth up to them. Hoe, and keep free from weeds.

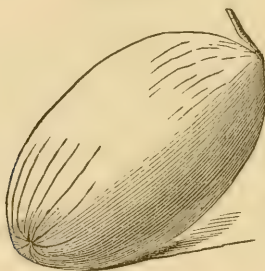
Soil and Situation. — Melons require a warm, dry, rich soil, with a small quantity of manure in each hill. They are easily raised in almost every part of the country, though they flourish better in the Middle and Southern States than further north.

VARIETIES.

Water-melon. — The sub-varieties of this sort are the *Imperial*, *Carolina*, *New Jersey* and *Spanish*; also, the *Citron*. These are well-known kinds, and are extensively grown. By many they are considered as forming a dis-

tinct species of fruit, of themselves. The first-named is a productive sort, nearly round; color palish-green, and white; flesh pink, rich, pleasant. The Carolina (Fig. 159) is a very popular variety; large size; oblong; color green and white; flesh red; sweet, agreeable flavor.

Fig. 159.



Musk-melon. — A delicious fruit, a native of Persia. The varieties are numerous, easily propagated from seeds. The principal sorts are the *Keising*, an egg-shaped, light straw color, highly flavored variety; *Green Hoosainee*, a superior and prolific sort; *Large Germek*, round, sea-green colored, richly flavored, and productive; *Early Canteleup*, ripens early and bears well, rather small-sized, thin skin, orange-colored flesh, juicy, and of good flavor; *Nutmeg*, green-fleshed, large, roundish oval, tender, sweet, pleasant flavor. Besides these, the *Green Citron*, *Palermo*, *Orange Canteleup*, *Black Rock*, and *Sweet Ispahan*, are good kinds, worthy of cultivation.

THE MULBERRY.

Propagation. — It may be propagated by seed, sown in a warm border, but this mode is rarely pursued; by layers — lateral shoots obtained by heading down the tree near to the ground; by cuttings, having two thirds of their length old wood, and one third yearling; or by lopping off a straight branch, eight feet long, from a large tree, — the nearer the trunk the better. Make it clear of every little stem, then dig a hole four feet deep, plant the naked branch firmly in the ground, leaving around it a cavity to hold water, when the season is dry. In two years it will bear fruit.

Soil and Situation. — It prefers a moist, deep, loamy soil, and a some what free exposure to the south. The soil should not be cold, or wet, and should be well drained. It may be trained against a wall, but this requires much space.

VARIETIES.

Red. — This is a common variety, growing wild in the United States. The fruit is of a deep-red color, and of excellent flavor.

Black. — This variety hails from Asia Minor, but thrives in a northern

Fig. 160.



climate. The berry is large and long, black, and of a rich aromatic taste. It is used in making wine, or cider, mixed with apples.

REMARKS. — The *Johnson* is a new variety, and it bids fair to sustain the high character given it by Professor Kirtland. Fruit large, oblong, of a mild and pleasant flavor. Of the *White Mulberry* there are several sorts; not, however, so valuable for their fruit as for silk.

THE NECTARINE.

REMARKS. — The nectarine is not uncommonly classed with the peach, as a distinct variety, the peculiarities consisting in the fruit being smooth and naked, without fur or down, and the flesh being firmer. There is no doubt of their identity, as the seed of the peach sometimes produces the nectarine, and *vice versa*. It is propagated and grown the same as the peach (which see).

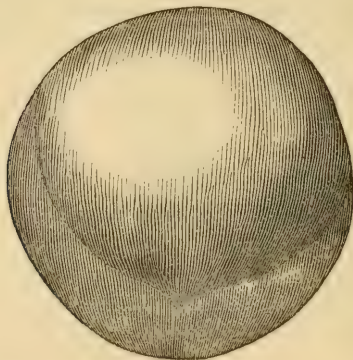
VARIETIES.

Boston. — Also known as *Lewis's* and *Perkins's Seedling*. Originated in Boston, where it was raised from a peach-stone. The fruit is very handsome, of medium size, and heart-shaped; color bright yellow and red; flesh firm, sweet, pleasant. One of the best varieties for general cultivation.

Red Roman. — One of the most hardy. It is a large, handsome, red

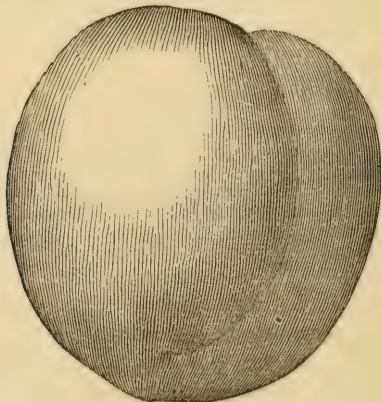
cling-stone ; color dark next the sun, the shaded side yellow ; flesh juicy, sweet, and vinous. Ripe in August and September. A good bearer.

Fig. 161.



Jaune Lisse, or Roussanne. — A small, round fruit ; skin yellow, a little spotted with red towards the sun ; skin smooth ; flesh yellow, firm, sweet, highly flavored. Ripens in September and October. Fig. 161.

Fig. 162.



Etruge. — A fine fruit, very popular. Medium size ; roundish ; pale-green, deep-red next the sun ; flesh palish-white, tender, juicy ; ripe in September.

Early Violet. — Medium size ; green, and purplish red ; flesh pale yellow, and pinkish ; soft, rich, sweet, agreeable flavor. Ripe last of August. Good bearer ; very superior.

Musk Violet. — This fruit is of large size ; color a yellowish-white, a fine red violet towards the sun, with whitish spots ; flesh yellowish-white, firm, vinous, sweet and musky. Ripe in September. Fig. 162.

REMARKS. — *Hunt's Tawney*, *Downton*, *New White*, *Broomfield*, *Pitmas-ton's Orange*, and *Duc du Tellier's*, are recommended to growers.

THE PEACH.

Propagation. — It may be propagated by planting the stone in the fall, at a depth of two or three inches, and in one or two years they will be of sufficient size to transplant. A common way of increasing them is by budding on the plum stock or the bitter almond ; usually inoculated on the peach stock. Plant from ten to twelve feet apart, and the land may be cultivated with manured crops of corn, potatoes, vines, or pulse.

Soil and Situation. — A rich, sandy loam is the best, — a natural or artificial soil of this description. It is best not to manure much, except when the land is also occupied by other crops, like those just mentioned.

Culture, &c. — When transplanted, they should not be very large, — generally not more than two years' growth. Good varieties are obtained by budding ; grafting is thought, on the whole, to be hardly of much benefit.

VARIETIES.

Early York. — One of the earliest and most generally cultivated varieties. Size medium, roundish, slightly oval ; skin thin, somewhat dotted ; color red ; flesh greenish-white, tender, rich, lively flavor. Ripens middle or 'ast of August.

Red Cheek Melocoton. — A large yellow clear-stone, with a red cheek ; flesh rich and juicy ; ripens in September, — sometimes earlier.

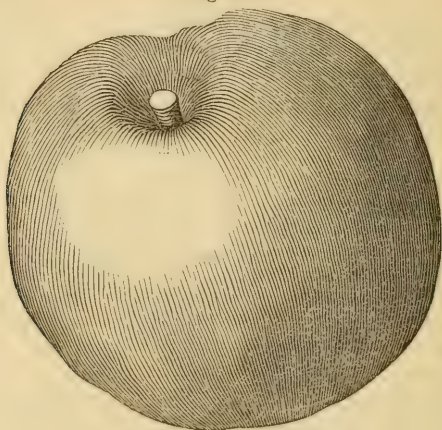
Gross Mignonne. — A large, round peach, flattened at the ends, divided by a deep furrow into unequal parts ; the stem small, a small point at the blossom end ; skin covered with a thin fine down, color a clear green, approaching to yellow, deep brownish-red towards the sun ; flesh fine, melting, juicy, delicate and white, tinged with red near the stone ; the juice is sweet, vinous and sprightly. Ripens in August. Fig. 163.

George the Fourth. — Medium size, globular form ; color pale yellow and dark red ; flesh melting, rich, superior flavor. Ripens in September.

Coolidge's Favorite. — Fruit large and roundish ; skin smooth, white,

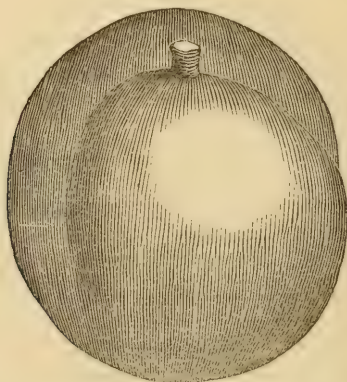
with red towards the sun ; flesh tender, juicy, sweet, finely flavored. Hardy, and a good bearer, ripening early in September. Much thought of.

Fig. 163.



Alberge. — Size medium ; yellow skin, with dark red cheek ; flesh yellow, tinged with red, melting, rich, sweet, and vinous flavor. It is deeply

Fig. 164.



indented by a seam running from the stem to the blossom end. Ripens last of August.

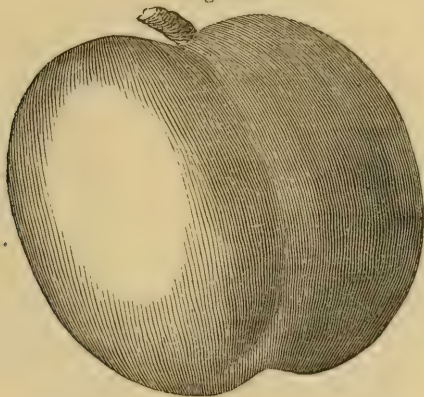
Bergen's Yellow. — Large size, round, slightly depressed ; color red and orange, dotted ; flesh yellow, tender, rich and luscious ; good bearer, and ripens first of October. A valuable sort.

Morris White. — Fruit large, round or oval ; color white, greenish, slight purple tinge ; flesh white, tender, rich, and sweet. Ripe middle of September.

Oldmixon Freestone. — A beautiful, large, flat peach, with a white skin and red cheek ; flesh rich, juicy, luscious. Ripe in August.

Red Magdalen. — Medium size ; round, flat next to the stem ; color a fine

Fig. 165.



red towards the sun ; flesh white, reddish near the stone, sweet and sprightly. Ripens in September. Hardy and productive.

Crawford's Late. — Fruit large, round, and handsome ; yellow in the shade, deep red towards the sun ; flesh yellow, reddish near the stone, juicy, tender, rich, finely flavored. Ripens about the last of September or first of October.

Red Rareripec. — An excellent fruit, frequently called Morris's Red Rare-ripe ; size quite large, round ; color red and white ; flesh tender, rich, melting, highly flavored. Ripens in August.

Yellow Rareripec. — Size large, globular ; color yellow, and purplish red ; flesh yellow, red near the stone ; tender, juicy, vinous flavor. Ripens in September.

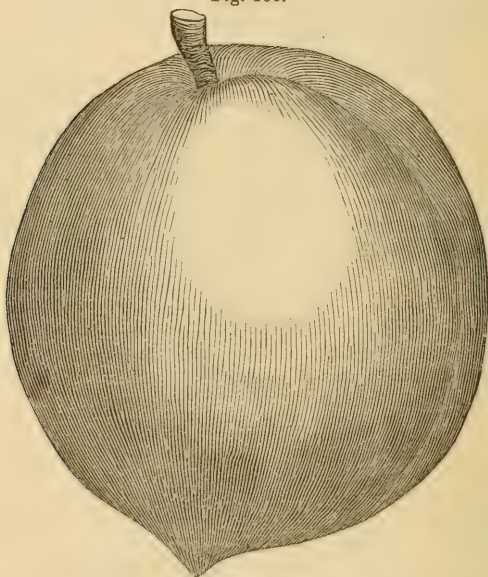
Noblesse. — A large and handsome clingstone ; skin white, with a pale blush, and some dark brownish spots ; flesh rich and highly flavored. Ripens in September.

Lemon Freestone.— A pale yellow, whitish fruit; medium size; flesh juicy, tender, melting, and highly flavored. Ripens in September.

Monstrous Cling.— A large, roundish-oval fruit; color palish-yellow with deep red tinge; flesh solid, juicy, and sweet. Ripens in October.

Late Heath.— Large, oblong, terminating in a point at the head; color rich cream-colored white, sometimes faintly blushed; flesh rich, tender,

Fig. 166.



juicy, and melting. Hardy, and ripens in September, lasting into November.

Early Tillotson.— A medium size, round fruit; color yellowish white, red, with dots; flesh white, red near the stone, juicy, melting, excellent flavor.

REMARKS. — The varieties, besides those mentioned above, worthy to be recommended for general cultivation, are the *Jaques*, *White Imperial*, *President*, *Late Admirable*, *Ward's Late Free*, *Golden Ball*, *Hyslop's Cling*, *Old Newington*, *Malta*, *Nutmeg*, *Belle de Vitry*, *Incomparable*, *Catharine*, *Chancellor*, and *Late Purple*.

THE PEAR.

Propagation. — The pear may be propagated by layers or suckers, but not so readily by cuttings. These modes, however, are productive of very indifferent plants, and are usually rejected in favor of raising from seed, and grafting or budding; by seed, either for the purpose of obtaining new varieties, or to produce pear stocks. But, as the varieties of the pear do not reproduce themselves from the seed, and seedlings are slow in giving their fruit, the pear is principally grown by scions and buds. These are placed on pear or quince stalks, according as taste or interest may invite to early and small crops, of fine quality, or to later and more abundant ones, of inferior character. In the former case, the stem of the quince is advantageously employed, and in the latter, that of the common pear, and without any material difference in the operation, excepting that the feebler the stem, the nearer to the earth should be placed the scion or bud.

The second year after budding or grafting, the plants may be removed to the places where it is intended they shall stand.

Soil and Situation. — Though the pear-tree may be made to grow almost anywhere, still it succeeds poorly on the north sides of hills, or in stiff, dry soils, and still worse on those having a wet subsoil. Some of the later and finer varieties require a deep, substantial loam, occasionally refreshed with a dressing of well-rotted dung; and some of the best aspects the garden can furnish are also desirable.

Culture, &c. — Cultivated as standards and pyramids, the young trees should be left, in a great degree, to regulate their own shape. To produce a well-balanced tree, shorten the wood of the deficient side, and leave the other to itself. Trees of other forms, and intended for walls and espaliers, require more labor and management, and a degree of both summer and winter pruning; the former of which consists in rubbing off all foreright, ill-placed, spongy shoots, before they become hard, while the latter consists in sparing all such well-placed and thrifty laterals as may be necessary for preserving the form given to the head of the tree, and cutting away all others close to the branch from which they grow. If the older wood be diseased or redundant, cut it away also, or shorten it down to some healthy and promising shoot.

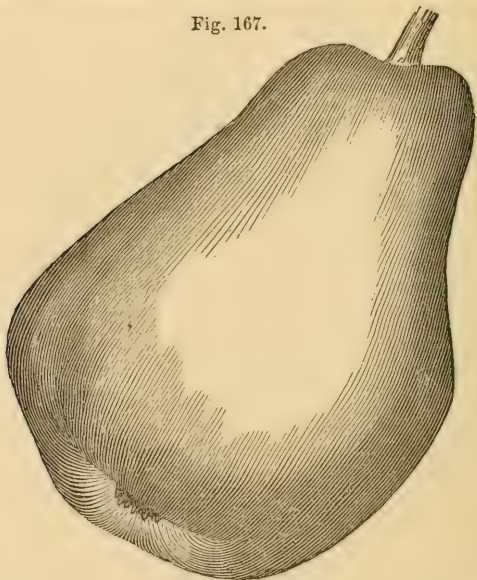
When an old tree becomes unproductive, either cut down within about two feet from the ground, and train up anew some selected shoots which may have pushed from the stump, or take off at its base every branch which does not want at least twenty degrees of being perpendicular, and all spurs from such other branches as by this rule will be left. Into these retained branches, at their subdivisions, and at different distances from their bases,

quite to their extremities, grafts must be carefully inserted, which, when about twelve inches long, must be trained downwards between the branches.

VARIETIES.

Bartlett. — One of the most valued sorts, and grown in almost every part of the country. Fruit large, pyramidal; color yellowish at maturity, thin,

Fig. 167.



and smooth; flesh white, delicate, buttery, sweet, juicy, highly flavored. Hardy, productive, keeps well, ripens in October. It stands about number one among all the pear-tribe.

Madeleine. — Medium size; pale yellow, sometimes with a blush towards the sun; form obovate, tapering to the stalk; flesh white, tender, juicy, refined flavor; one of the best and earliest pears; hardy, and a good bearer.

Dearborn's Seedling. — A valuable early sort; small, symmetrical; color light yellow, with a few dots; flesh white, tender, sweet, and sprightly flavor. Is quite productive, early, ripening from the middle to last of August.

Winter Nelis. — A fine winter variety; size rather above medium; roundish-obovate; color pale straw, slightly brown; flesh white, soft, sugary, rich, musty-flavored; ripe in December; not very productive, but excellent. Fig. 168.

Fig. 168.

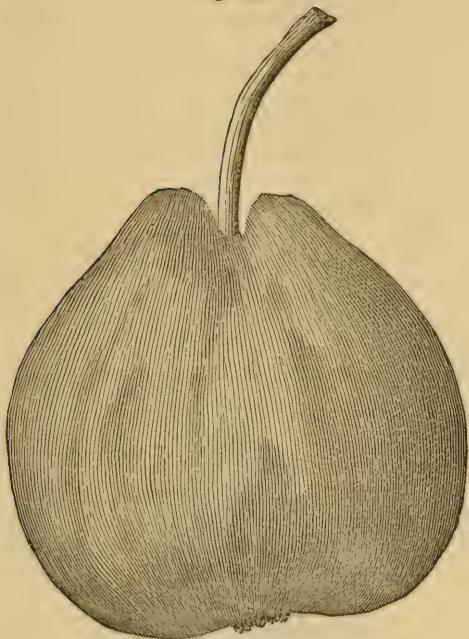
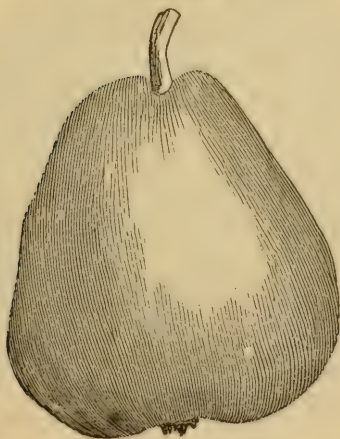


Fig. 169.

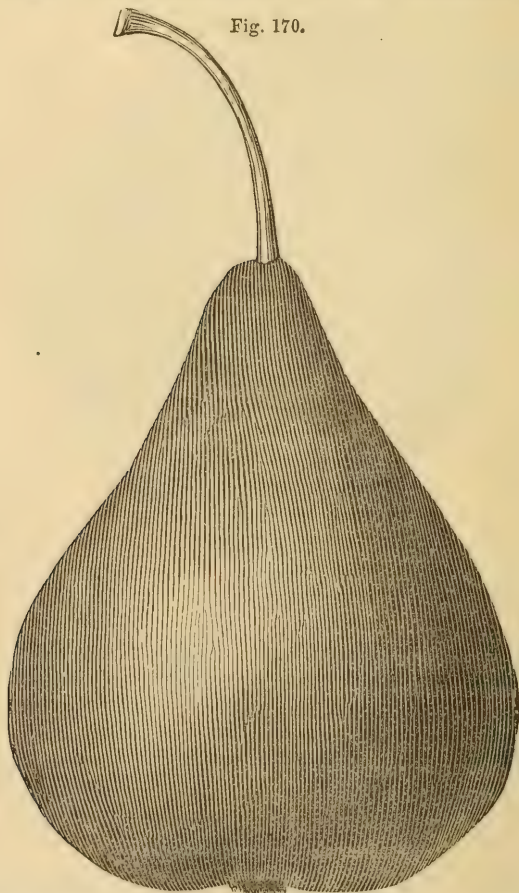


Seckel. — Size generally small ; form regular, round at the blossom end, contracting gradually towards the stem ; color sometimes yellow, with a bright red cheek, and at other times a complete russet, without any blush ; flesh melting, juicy, exquisitely flavored. Ripe in Sept. and Oct. Fig. 169.

Tyson. — A medium-sized fruit ; color light straw, with brownish blotches ; flesh lightish-white, rich, sweet, fragrant ; ripens in September.

Beurre Bosc. — Fruit large and long ; color light cinnamon russet ; flesh

Fig. 170.



white, rich, tender, delicious. A moderately productive variety, ripening in October and November. Fig. 170.

Bloodgood. — Large size; form oval; color dull yellow, with darkish spots; flesh soft, melting, agreeable flavor; early and prolific. Ripens in August.

Flemish Beauty. — Fine large fruit; color dull yellow and brownish: flesh yellowish tinge, sweet, tender, juicy, sugary, musky flavor. Ripe in October. One of the best sorts, though not so much cultivated as it deserves.

Golden Beurré of Bilboa. — Medium size, oblong, roundish at the crown contracted towards the summit; color light yellow, with russet spots; flesh tender, melting, rich, excellent flavor. Ripens in October, and very fruitful.

Summer Frank Real. — Medium size, obovate, thickest in the middle; color light yellow, with brownish-green dots; flesh melting, rich, fine-grained, sweet, and of superior flavor. Ripens in September; hardy; fruitful.

Muscadine. — Medium size, roundish, symmetrical; color yellowish-green, with dots of brown; flesh white, buttery, rich, musky flavor. Ripens in

Fig. 171.



September, bearing abundantly, and is altogether a very valuable sort.

REMARKS.—There are many other varieties which might be strongly recommended, but we can only give the names, without attempting to give a full description. Among the Summer, or early sorts, worthy of being noticed, are the *Summer Melting*, *Stevens's Genesee*, *Honey*, *Jargonelle*, *Beurré d'Amaulis*, and the *Roussellet de Rheims*; of the Autumn sorts, among the best are the *Belle Lucrative*, *Marie Louise*, *Swan's Egg*, *Cushing*, *Frederic of Wurtemberg*, *Fulton*, *Saint Michael*, *Bleeker's Meadow*, and *Belle et Bonne*; of the Winter sorts, the most desirable are the *Colmar*, *Columbia*, *Vergou-leuse*, *Pound*, *St. Germaine*, *Glout Merccau*, *Easter Beurre*, *Beurre Diel*, and *Passe Colmar*.

THE PLUM.

Propagation.—The plum, like other stone-fruit, is mostly propagated by budding, the stocks being the free-growing plum, either raised from seed, or, more commonly, from layers or suckers.

Soil and Situation.—The plum naturally does not grow in so light a soil as the cherry, nor in so clayey a soil as the apple; and in a state of culture, a medium soil, on a dry subsoil, is found to be the best. Only the finer kinds are planted against walls.

Culture, &c.—All the varieties produce their blossoms on small spurs, which are protruded along the sides of the shoots of one, two, or three years' growth,—generally in the course of the second or third year. These spurs, if duly thinned, and, when necessary, cut in, will continue bearing for five or six years, or longer. Standard trees require very little pruning, beyond that of occasionally thinning out the branches, which should be done before midsummer, to prevent the gum from appearing on the wounds. Plum-trees against walls or espaliers are generally trained horizontally. Old trees may be renovated by heading in or cutting down. The plum is forced in the same manner as the peach.

VARIETIES.

Jefferson.—A superior dessert sort. Fruit large, oval, contracting towards the stalk; color bright, deep yellow, with a purplish-red cheek, and a whitish bloom; flesh orange, quite juicy, richly flavored. Ripens from the middle to the last of September; a good bearer. Fig. 172.

Green Gage.—Of this plum there are several varieties. The size, in good soils, is large, the form round, and the skin green; the flesh is green, melting, juicy, and exquisitely flavored. Ripens in August and September. Fig. 173.

Washington.—A well-known variety; originated in New York State; large, oval; color bright yellow, with red dots; flesh yellow, sugary, excellent eating. Hardy; shy bearer; ripens in September.

Fig. 172.

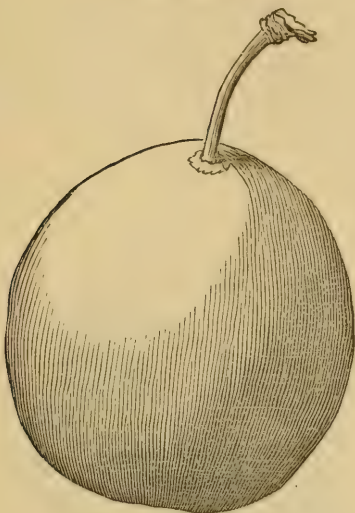
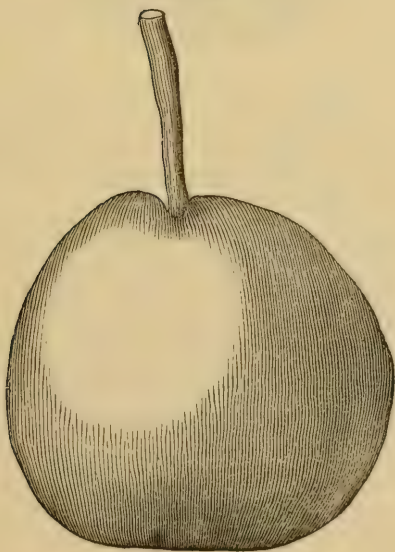


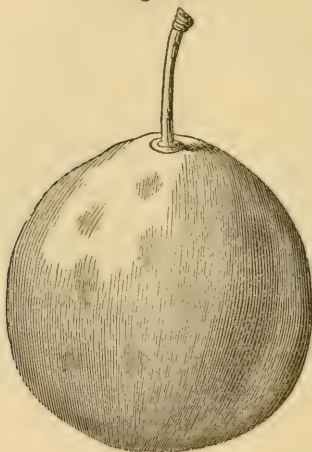
Fig. 173.



Coe's Golden Drop. — Thrifty growth; good bearer; fruit large and handsome, oblong; color greenish-yellow, with violet and crimson dots; flesh orange color, rich, juicy, finely flavored. Ripens in September.

Purple Favorite. — Large size; roundish; color light brown, with a shading of purple, and bright yellow dots; flesh greenish, soft, sweet, and

Fig. 174.



excellent flavor. Ripens last of September, and bears well.

Red Gage. — Known also as *Long Scarlet*, and *Scarlet Gage*. Medium size; oblong, tapering towards the stalk; color brilliant red toward the sun, and yellowish in the shade, covered with a light purplish bloom; flesh yellow, rich, and sweet. Ripens first of September.

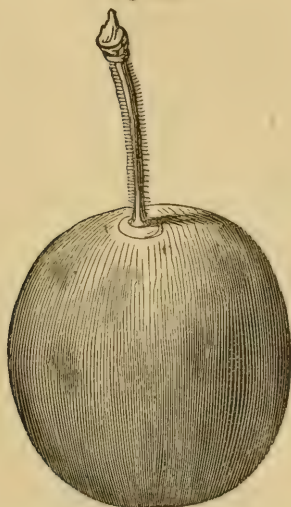
Morocco. — Medium size; round; deep purple; flesh slightly yellow, tender, sweet, richly flavored. Ripens about the last of August.

Drap d'Or. — *Cloth of Gold*, by some. Small, round; color rich, brilliant yellow, reddish toward the sun; flesh yellow, sweet, not so juicy as some kinds. A clearstone; ripens in August; a pretty fair bearer.

Yellow Egg. — Large size; oval, narrowing at both ends; color yellow, whitish dots, and a thin white bloom; flesh somewhat coarse, yellow slightly acid. Ripens in September. A better cooking than eating plum.

Bleeker's Gage. — Medium size, nearly round, very regular; color dark yellow, with deep red spots; flesh yellow, sweet, finely flavored. Ripens in September. The tree is hardy, productive, and the fruit much esteemed in some parts. Fig. 175.

Fig. 175.



Duane's Purple.— Large size ; oval, or oblong bulging on one side ;

Fig. 176.



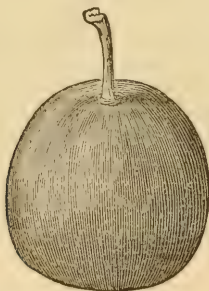
color reddish-purple toward the sun, palish-red in the shade, with a few yellow specks, and a lilac bloom; flesh light brown, juicy, lively, slightly acid. Ripens middle of August.

Royal Hative. — Also called *Early Royal*. Medium size; round; color purple, with dark yellowish spots and streaks, blue bloom; flesh yellow, tender, richly flavored. Early, thrifty, productive; ripens early in September.

M Laughlin. — Large size, round; color brownish-yellow, with a red tinge; flesh melting, juicy, fine flavor, though not superior. Ripens in August.

Frost Gage. — Fruit rather small; roundish; color dark purple, with brown dots; flesh greenish-yellow, juicy, saccharine, agreeable flavor.

Fig. 177.



Ripens in October; moderately productive: a good sort for cooking purposes.

REMARKS. — We have enumerated the most valuable sorts, though there are others more adapted, perhaps, to certain localities, or preferred by amateurs; such as the *Imperial Ottoman*, *Elfrey*, *Smith's Orleans*, *Flushing Gage*, *Red Diaper*, *Lombard*, *Black Dawson*, *Huling's Superb*, *Blue Dwarf Gage*, and *Prince's Imperial Gage*.

THE QUINCE.

Propagation, &c. — The quince is, as all know, a low, much-branched, crowded, and irregular tree, blossoming in May or June, and ripening its fruit in October or November. It is generally propagated by layers, but cuttings root without difficulty. The best standards are produced by grafting, at the height of five or six feet, on the pear, the thorn, or the mountain ash.

The quince is generally planted in the orchard, in some part where the

soil is good, and not very dry; it bears on two years' old wood, and requires little pruning, except thinning out irregular, crowding, or decaying branches. The fruit is kept by packing in sand or dry straw.

It is said that the quince will grow on any soil that will give good corn or potato crops. The soil should be well prepared by ploughing and subsoil ploughing, and a clean furrow obtained, in the bottom of each furrow manure being thrown. After this, planting should commence, — spring or autumn answering equally as well. The holes should be dug twice as large as the roots of the tree, and a foot and a half deep, and to each tree a liberal supply of good compost manure should be given. The branches should be shortened in, one half of the last year's growth, before the trees are set, and the roots should be saturated with water before being covered over with the earth. Press the earth moderately about the roots, and leave the soil around the trunk concave, like a saucer, to catch the showers. This will secure life and thrift to the trees.

In orchard planting, the trees should be put out in rows twelve feet apart, the trees ten feet asunder. This will be near enough, in good soil, prepared as above. In three years they will bear, and will continue to do so for thirty years. The open space between the trees may be profitably cropped with potatoes, and so forth.

The pruning should be done in the autumn, just after the fall of the leaf. The operation consists in cutting out as little as possible, mainly old or decayed wood, or any quite superfluous branches.

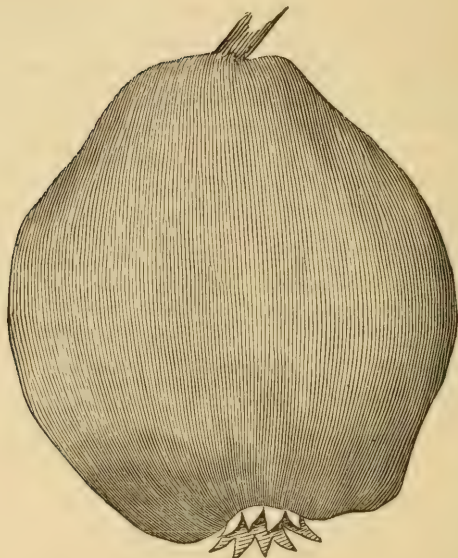
In November, fork in around the roots of each tree five or six shovel-fuls of fresh stable manure; and when the spring opens, plough the ground between the rows, and lightly stir beneath the trees. Directly after this, give the whole a broadcast spread of salt, at the rate of ten bushels to the acre, or just a light coat, sufficient to half conceal the ground under each tree. The best salt for this purpose is the refuse salt of the packing-houses.

VARIETIES.

Apple-shaped. — This is also called *Orange*, a well-known, favorite variety. Fruit large, much resembling an apple in shape; color brilliant yellow; flesh solid, and of fine flavor. A very good bearer, and much esteemed as an excellent cooking variety, on account of the flesh becoming soft when stewed. Fig. 178.

Pear-shaped. — Medium size, oblong, contracting towards the stem, and in general form very similar to a pear; color yellow; flesh firmer and yields less when cooked than the Apple-shaped. It is not so finely flavored as the Apple, and not generally so much esteemed.

Fig. 178.



Portugal. — This variety is more juicy, less harsh, better colored and flavored, than the two preceding. Fruit large, oblong; color mild yellow; not very productive. A very superior variety, though not so much raised as it deserves.

REMARKS. — There are two or three ornamental varieties, but they are not of sufficient importance to be described at length.

THE RASPBERRY.

Propagation, &c. — The only mode of propagation is by suckers, except by seeds, which is only resorted to for new varieties. The suckers are separated in autumn, either by taking up the whole plant and dividing it, or by slipping them off from the sides and roots of the main stock. They may be planted at once where they are permanently to remain, in rows from north to south, four feet apart every way. They will grow in any good garden soil, but it is most prolific in fruit, and the fruit is better flavored, in a dry, substantial soil, and an open situation. In making a plantation, three or more suckers are allowed to each stool, and planted in a triangle at six inches apart. The plants will produce fruit the first year;

but, if this fruit, or even a third part of it, can be dispensed with, the suckers for the succeeding year will be greatly strengthened by cutting the stems of the newly-set plants down to within six inches of the ground. The future treatment consists in going over the stools every year, early in May, and selecting six or seven of the strongest suckers from each stool for next year's bearing wood, and destroying all the rest, unless they are wanted for a new plantation. In autumn, as soon as the fruit is all gathered, the stems which have borne it should be cut down to the ground, to give light and air to the suckers ; but as these are liable to be injured by the frost, they should not be pruned till the following March. They may then be shortened to two thirds or three fourths of their length, by cutting off the weak wood at the extremities of the shoots.

VARIETIES.

Fastolff. — This is a very superior variety, considered by many the best

Fig. 179.



of all the reds. Fruit extra large size ; roundish-conical ; color brilliant red, purple tinge ; flesh rich, melting, finely flavored. It is not so much grown now as it undoubtedly will be when it is better known ; besides, the plants are scarce and high-priced. It is well adapted to the United States.

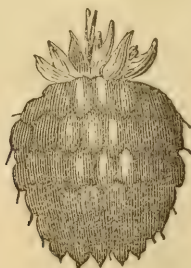
Yellow Antwerp. — *White Antwerp*, and *Double-Bearing Yellow*, by some. A large, conical berry ; color lightish-yellow ; flesh sweet, very pleasant flavor. Worthy of cultivation.

American Black. — A well-known popular variety ; size rather small, in its native growth ; color quite dark ; flesh rich, juicy, acid flavor.

Red Antwerp. — Also called *New Red*, *True Red*, and *Howland's Red*. Large size ; conical ; color pale red ; flesh sweet, juicy, excellent. It is early, productive, and ranks first-rate for eating and cooking.

Franconia — Fruit large ; obtuse-conical ; color purplish-red ; flesh firm, rich, tart, lively. Hardy, productive ; not so early as others, but superior for preserving. Fig. 180.

Fig. 180.



REMARKS. — The *White Antwerp* is an excellent sort, as is also the *Cushing*, and the *Ohio*. These, with the varieties previously described, constitute the principal cultivated kinds, the others being generally inferior.

THE STRAWBERRY.

Propagation and Culture. — The usual time for transplanting strawberry plants is August. That time is chosen because they have then done bearing, and have made offsets, if the season has been favorable, of strong plants, set from their runners. Plantations made at this season will bear some fruit the next summer. But, if good, vigorous plants can be obtained in May of the preceding season, it should be planted then, as it saves nearly a year, the plants being ready to bear abundantly the next year.

Gardeners have different habits and opinions as to trimming the plants,



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when they are put out. Some cut off all the old leaves, preserving only those in the centre of the plant. Others take off the dead or decayed leaves only, and plant with all the old healthy leaves on the plant. Many persons cut the roots in before they put them into the ground ; — all dead substances should be cut off, but not the roots. When the plants are put out, they should be kept free from weeds, and the ground should be kept loose about them. If the plants are strong, put but one to form the stools : if weak, put two.

As regards the distance at which plants should be set, cultivators differ. The common red strawberry, which is found in all our gardens, may be put eight inches apart, in rows nine inches or a foot from each other, and allowed to form a matted bed of about two feet wide, with a foot-path of a foot wide between them. But the larger and finer sorts should be planted in stools, in beds four and a half feet wide, with a path of fifteen inches or more between the beds. In these beds the plants should be set, by a line, fifteen to eighteen inches apart, both ways, taking care that they do not run together.

The objection generally made to this mode of cultivation is, that the fruit is exposed to injury by lying upon the ground, where it is bruised, and covered with dirt, every time it rains. This, however, may be prevented by a little care. Moss, or straw, or the leaves of trees, may be put around the stools, so as to prevent the fruit from lying on the ground, and to prevent the moisture around the plant from evaporating.

The strawberry may also be propagated by seeds ; and, if sown immediately after gathering, will produce plants which will come into bearing the following year.

Soil and Situation. — The best soil is one that is light, warm, and gravelly ; and the manure to be applied should be vegetable, rather than animal. The common practice is to manure the ground with rotten dung, with a view to increase the size and quantity of the fruit ; but, in doing this, the flavor of the fruit is destroyed in proportion to the richness of the soil ; besides, high manuring produces strong, luxuriant vines, and little fruit. Rotten leaves, decayed wood, ashes, in small quantity, mixed with other vegetable substances in a compost heap, will make better manure for strawberries than any animal substance whatever. As the vines which bear this fruit require great moisture to bring the fruit to its proper size, the soil and situation must not be too dry.

Forcing. — Select for this purpose, in the middle of August, a sufficient number of the best runners, from approved kinds, to have choice from, and plant them six inches apart, in beds, upon a strong border, in a dry and sheltered situation. As soon as the leaves have withered, mulch them

lightly with manure ; and if very severe weather occur, protect them for a time with straw. They must be kept, the following spring, free from weeds and runners, removing also any flowers as they appear. Towards the latter end of May, or beginning of June, whenever dull or rainy weather may occur, remove them carefully into forty-eight-sized pots, putting one, two or three plants into each pot, according as the object may be, whether quality or quantity. Place them, when potted, in a situation where they can be readily shaded for a time, and receive regular supplies of water, if necessary. About the latter end of July, or early in August, these pots will be filled with roots, when the plants must be re-potted into flat thirty-two-sized pots, and at this time plunged in old tan or coal-ashes. The best mode of plunging them is to form beds wide enough to contain five rows of pots, when plunged, upon a hard or gravelly surface, to prevent them rooting through, the sides supported by slabs of the same width as the depth of the pots, and filling them up with old tan or ashes, the plants remain here until wanted to take in, and are easily protected from severe frosts. It will be found an excellent plan to preserve the latest forced plants, which are not much exhausted, for forcing the first, the next season. These, from their long period of rest, and well-ripened buds, are predisposed to break earlier and stronger than the others ; some of them, if the autumn is moist, will be excited, and produce flowers, which must be immediately pinched out. They should have their balls carefully reduced, and be re-potted in larger pots, early in August, protecting them from the late autumnal rains, and from frost.

VARIETIES.

Duke of Kent. — Fruit rather small size ; roundish-conical ; color bright, deep red ; flavor tart, and moderately good. It is, on the whole, considerably inferior to other sorts, but is an early ripener, — say the last of May, or first of June.

Large Early Scarlet. — This also is an early fruit, and superior to the

Fig. 181.



Duke of Kent. Medium size; roundish-oblong; color brilliant red; rich, sprightly and excellent flavor. A certain and abundant bearer.

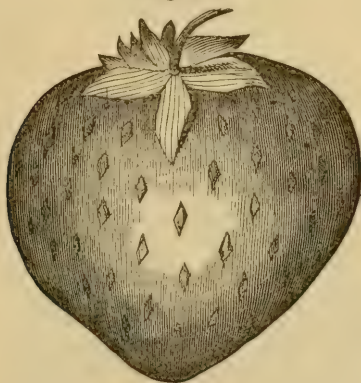
Red Wood. — An old and favorite sort; size small; round; color scarlet; flesh sweet, finely flavored. Productive, ripening in midsummer.

Black Prince. — Also known as *Black Imperial*. Fruit large, handsome; roundish; color darkish-red; flesh rich, finely flavored. Hardy and prolific.

Hovey's Seedling. — One of the finest and largest, and well suited to a northern climate; form roundish-conical, regular; color dark red; texture and flavor very fine. A good bearer, ripening about the middle of June.

The fruit, with commonly good culture, weighs about a quarter of an ounce,

Fig. 182.



and is an inch and a quarter in diameter. It produces better if grown near some variety having perfect stamens, such as the Early Scarlet, or Ross Phœnix.

Swainstone's Seedling. — A comparatively fine sort, well thought of by those who have grown it. Large size; ovate-conical; color light, shiny scarlet; flesh compact, delicious flavor. Not over productive. Fig. 183.

Ross Phœnix. — Large size to very large, with numerous seeds; form generally more or less coxcombed or flattened, and surface uneven; color dark crimson; flavor and texture very fine for a large variety. Productive; ripens in June, and is considered nearly equal to Hovey's Seedling. Fig. 184.

Prolific Hautbois. — Large size; conical; color purplish-red; flesh rich, juicy, tender, highly flavored. It bears very well, ripens early, and has as good a reputation as any of the Hautbois variety. Fig. 185.

Fig. 183.

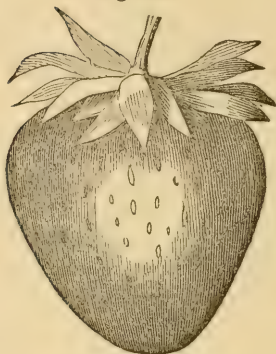
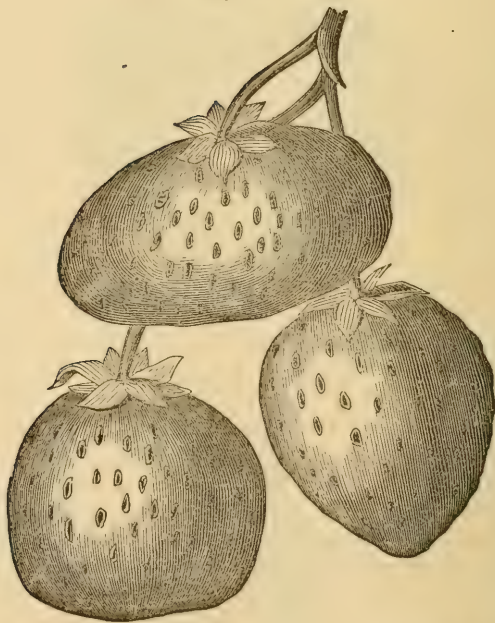


Fig. 184.



Cushing.—Fruit very large ; round, some of the berries with a short neck ; color light scarlet ; flesh juicy, tender, finely flavored ; good bearer.
Fig. 186.

Fig. 185.

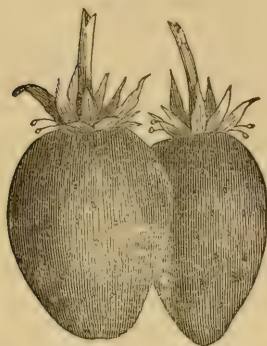
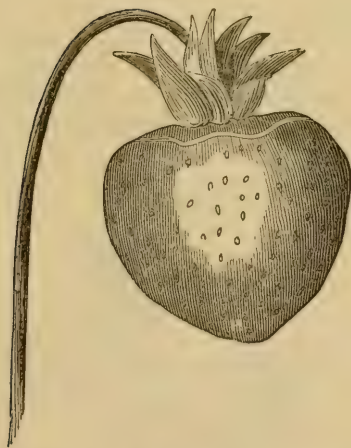


Fig. 186.



REMARKS. — The *Hudson's Bay*, *British Queen*, *White Alpine*, *White Wood*, *Bishop's Orange*, *Downton*, *Elton*, *Methven Scarlet*, *Boston Pine*, and *Myatt's Pine*, are esteemed varieties.

MISCELLANEOUS FRUITS, NUTS, &c.

ALMOND. — There are two kinds, — the common or sweet, and the bitter. The varieties best deserving culture are the *Tender-shelled*, the fruit of

which is small ; the *Sweet*, which is larger ; and the *Jordan*, also large and sweet. These, and all the other kinds, are propagated by budding on the plum, and sometimes on seedling almonds for dry situations.

BLUEBERRY. — A well-known dwarf bush, bearing a small berry, tender, juicy, blue color, ripening in July and August, and much used for tarts and puddings. Not much cultivated ; grows wild in abundance.

BUTTERNUT. — This is a species of walnut, growing in different parts of the United States, and sometimes called *Oil Nut* and *White Walnut*. Its wood is used for various mechanical purposes, and its bark possesses various medicinal qualities. The fruit is eaten, but is more valuable as a pickle.

CHESTNUT. — The true, sweet chestnut-tree thrives in any but moist or marshy soils. It is long-lived, and grows to a great size. Its wood is hard and durable, and used for various purposes ; the fruit is eaten raw, or boiled or roasted ; the bark, for tanning, is superior to oak. It is raised from the seeds, planted in the fall ; the second year they are transplanted, and fine varieties are extended by grafting. The Spanish or Portuguese chestnut succeeds well in this country, producing fruit, in about seven years, from the seed. Its growth is more rapid than the native kind. It may be budded on the common chestnut, but is apt to overgrow the stock.

FIG. — The figs most suitable for a garden are the large white *Genoa*, the

Fig. 187.



early white, the *Murray*, the small brown *Ischia*, and the black *Ischia*. Figs may be propagated by seeds, cuttings, layers, suckers, roots, and by ingraft-

ing; the best mode being by layers or cuttings, which bear the first or second year. A warm climate is required for out-door culture.

FILBERT. — There are several varieties, — the *Red*, the *White*, the *Barcelona*, or *Large Cob*, and the *Frizzled*. Filberts require a deep, light, but naturally fertile soil, without putrescent manures. They are propagated most easily from suckers, and should be well pruned. They bear in the fourth or fifth year.

LEMON. — A small tree, with ovate-oblong leaves, pale-green, with a winged stalk. Flowers red externally; fruit pale yellow, with a juicy and

Fig. 188.



very acid pulp. Generally raised from seed in the Eastern countries. In this country it may be raised at the South in the open air.

LIME. — The lime has obovate leaves on a wingless stalk, small white flowers, and roundish, pale-yellow fruit, with a nipple-like termination. The leaves and general habit of the plant resemble those of the lemon; but the acid of the pulp of the fruit, instead of being sharp and powerful, is flat and slightly bitter. The figure (190) represents the South American lime.

OLIVE. — The olive grows on a branchy, low, evergreen tree, requiring a warm climate and dry soil. The fruit is much in use for pickles, and in Europe a rich oil is extracted from the pulp, the fruit being first broken in a mill, and reduced to a sort of paste. It is then subjected to the action of a press, and the oil swims on the top of the water in the vessel beneath. In pickling, the fruit is simply preserved in salts and water. Fig. 189.

Fig. 189.



Fig. 190.



ORANGE. — The orange thrives only in a warm climate, though it is quite generally raised in hot-houses in cold latitudes ; more, however, for ornament and curiosity than for use. It rarely grows to any considerable height, has deep green leaves, and, when fruited, makes a fine appearance. May be raised by seed or by cuttings. The principal varieties are the *Bergamot*, the *Blood-Red*, the *Saint Michael's*, *Seville*, *China*, *Nice*, *Tangerine*, *Mandarin*. Fig. 191.

POMEGRANATE. — A small, low tree, in its form and habits not unlike the common hawthorn. It is propagated by layers and cuttings, and by grafting on the common sort ; or, it may be trained in the fan manner. The chief

Fig. 191.



sorts are the *Sweet*, the *Acid*, and the *Subacid*; besides which, there are some ornamental varieties. The fruit is about the size of a common apple, and is very handsome; skin hard; color yellowish-orange, with a deep-red cheek. Grows in the Middle and Southern States. Besides a dessert fruit, it is also used medicinally.

SHELLBARK. — Also called *Shagbark*, and *Hickory Nut*. A large and towering tree, with oval leaves; fruit roundish, sweet and relishing. The wood is much used for different mechanical purposes.

WALNUT. — Also called *Madeira Nut*. A tree of stately proportions, bearing in great quantity a large-sized and superior nut. May be propagated by seeds, and by grafting on the hickory nut. Excellent dessert fruit, and makes a good pickle. The kernel is four-lobed.

WHORTLEBERRY. — A small, dwarf shrub, comprising several varieties, and known generally by the name of *Huckleberry*, and *Bilberry*. It produces a round, sweet berry, much used in cooking, and also eaten raw. It grows wild, and is seldom cultivated in gardens.

FRUIT CALENDAR.

JANUARY. — *Vinery*: commence forcing for fruit in June; begin with a temperature of 50°, and gradually increase it, the first month, to 60°. *Peach-house*: commence forcing for fruit in May; begin with a temperature of 50°. *Cherry-house*: commence forcing with a temperature of 45°, by night. *Figs*: plants in pots may now be placed in a vinery. *Strawberries*: take plants in pots into a forcing house or pit twice in the

month. *Prune* the *Apple*, *Pear*, *Plum*, *Cherry*, *Gooseberry* *Currant*, and *Raspberry*, if the weather is not severe. Nail and tie wall and espalier trees.

FEBRUARY. — *Vinery*: increase the heat above that for the preceding month. *Peach-house*: cease syringing when the trees are in flower. *Cherry-house*: give air at every favorable opportunity. *Fig-house*: commence forcing where the trees are planted in the borders. *Melons*: sow seeds for early crop. *Strawberries*: take into the forcing-house for succession.

MARCH. — *Peach-house*: remove all fore-right shoots from the trees, and, when the fruit is set, syringe them. *Cherry-house*: increase the heat, after the bloom is set and stoned. *Fig-house*: water freely, both at the root and over-head. *Melons*: plant out from last month's sowing. *Strawberries*: give air freely while in flower. *Prune* and nail *Peaches* and *Nectarines*, and afterwards protect them with nets, or other covering. *Graft* fruit-trees.

APRIL. — *Vinery*: when the grapes are set, keep a very moist temperature, and commence thinning them immediately. *Peach-house*: partially thin the fruit before stoning; afterwards, thin to the quantity required to ripen off; — syringe the trees daily in fine weather, and smoke them occasionally, to keep down insects. *Fig-house*: when the shoots have made three or four joints, stop them, to cause them to produce fruit in the autumn. *Melons*: allow several of the main shoots to reach the sides of the frame before being stopped. *Disbud* *Peaches* and *Nectarines*.

MAY. — *Vinery*: keep the laterals stopped to one joint; take away all useless shoots. *Peach-house*: when the fruit begins to ripen, withhold water both at the roots and overhead, — at the same time, admit air freely. *Cherry-house*: raise the temperature to 70° when the fruit is swelling off. *Fig-house*: as the first crop approaches maturity, only sufficient water should be given to prevent the second crop of fruit falling off. *Melons* regulate the vines at an early stage of their growth; after the fruit is set, put pieces of slate beneath it. Continue to *disbud* wall-trees; remove their coverings when danger from frost is over, and wash the trees with soap-suds when the fruit is set. *Thin* the fruit of the *Apricot*.

JUNE. — *Vinery*: as the fruit approaches maturity, keep a dry atmosphere; — a few leaves may be taken off, or tied on one side, where they shade the fruit. *Peach-house*: suspend nets or mats beneath the trees, and place in them some soft material, for catching the falling fruit. *Cherry-house*: when the fruit is gathered, give the trees several good washings, to destroy insects, — the house should also be smoked. *Figs*: those in pots must be duly supplied with water. *Melons*: ridge out late crops; give air freely to ripening fruit. Summer-prune *Vines* against walls. Finally, thin *Apricots*. Set traps for wasps. Net *Cherry*-trees.

JULY. — *Vinery*: carefully avoid raising a dust when the fruit is ripe; give air freely. *Peach-house*: when the fruit is all gathered, give the trees several good washings over-head, and give abundance of air till the leaves begin to decay, when the lights may be removed. *Cherry-trees*: if in pots, these should now be placed in a shady situation. *Fig-house*: when the first crop is gathered, water the trees liberally, to bring forward the second crop. *Melons*: pay proper attention to the plants in the open air. Finally, thin wall-fruit. Prune and tie espalier trees. Bud fruit-trees. Pot *Strawberry* runners, for forcing. Mat *Currants* and *Gooseberries*, to preserve them. Stop the shoots of *vines* against walls, two joints above the fruit.

AUGUST. — *Vinery*: syringe the vines, and give them a root-watering after the fruit is cut, to prevent the leaves decaying prematurely. *Peach-house*: the light may be taken off the early house, and used for the purpose of forwarding *Grapes* against walls. *Fig-house*: syringe the trees frequently, to keep down insects. Make new plantations of *Strawberries*. Cut down the old canes of *Raspberries*, when the fruit is gathered. Keep the shoots of *wall-trees* nailed in, — displace all laterals. Stop the laterals of *vines* to one joint. Continue to bud fruit-trees, as in last month.

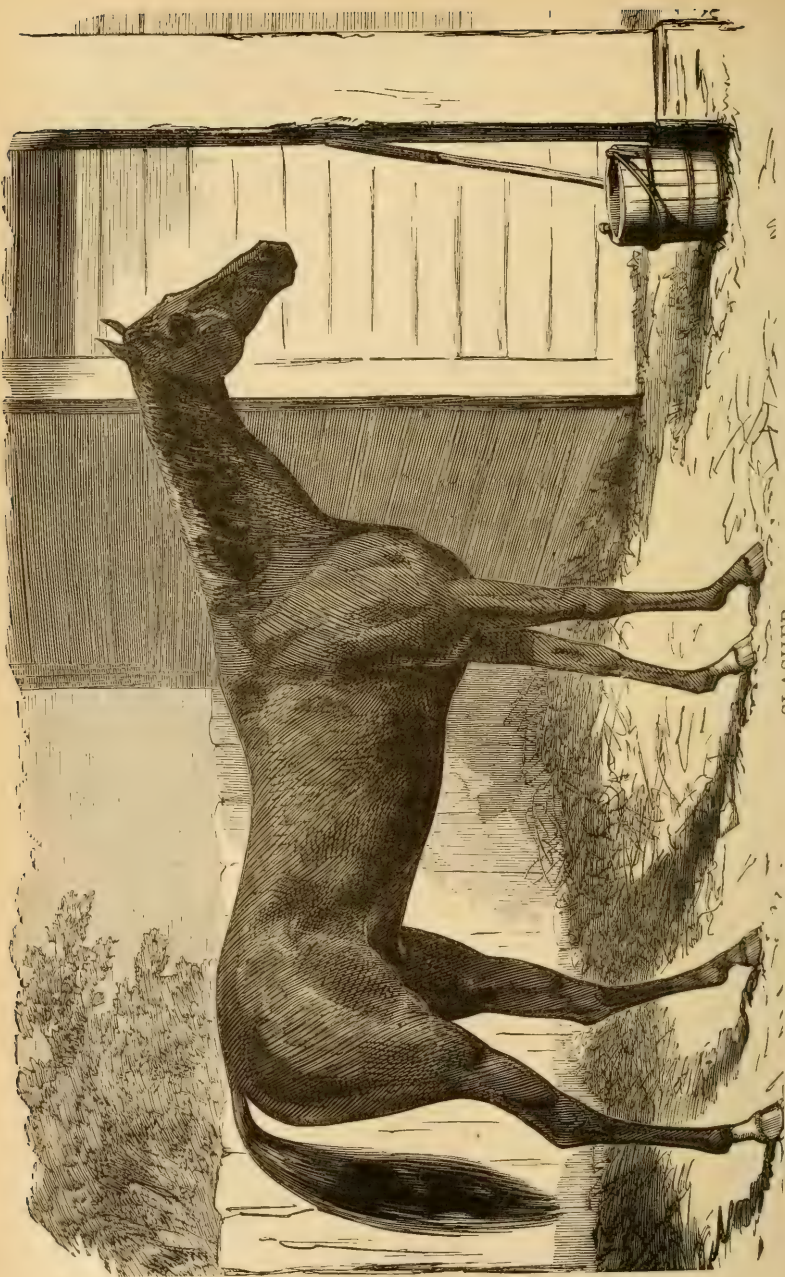
SEPTEMBER. — *Vinery*: the lights of the early forced-house should now be left open night and day; or they may be taken off, if repairs are required. *Peach-house*: if any vacancies are to be filled up, take out the old soil, and replace it with fresh, ready for planting next month. Protect out-door *Grapes* from wasps, by bagging the bunches. Gather fruit as it ripens. Expose wall-fruit to the sun and air, to give it flavor and color. Continue to make new *Strawberry* plantations, as in last month.

OCTOBER. — *Vinery*: as soon as the leaves have fallen from the vines, prune them, take off the loose, rough bark, and wash them. *Peach-house*: fill vacancies with trees from the walls in the open garden; take up and plant carefully. Pot *Cherry-trees* for forcing. Withhold water from *Fig-trees* when the fruit is gathered. *Melons*: keep up the heat of the beds, to forward the ripening of the late fruit. Gather any remaining fruit. Plant fruit-trees of all sorts. Prune *Currants* and *Gooseberries*.

NOVEMBER. — *Vinery*: protect the border where the vines of the early forcing-house are growing outside. *Peach-house*: prune and dress the trees as soon as the leaves are fallen. *Cherry-house*: if the lights have been taken off, they should now be replaced, but left open night and day, unless the weather is severe; the trees should now be pruned. Pot *Fig-trees* for forcing. Continue to plant all sorts of fruit-trees, as in last month. Protect *Fig-trees*. Prune the *Apple*, *Pear*, *Plum*, *Cherry*, *Filbert*, *Gooseberry*, and *Currant*, as in last month; also nail and tie those against walls, and espaliers.

Look over the fruit and the fruit-room. Mulch newly planted fruit-trees, to protect them from frost.

DECEMBER. — *Vinery*: put on the lights, if they have been removed, so as to protect the vines from severe frost. *Peach-house*: after the trees are tied to the trellis, take away a little of the loose, dry-top soil; slightly dig the border, so as not to injure the roots, and add some fresh soil. *Cherry-house*: fix the trees to the trellis, and make preparations for forcing next month. *Fig-house*: the frost should be kept out, and if the trees need any pruning, it should now be done. Continue to nail and prune in mild weather. Partially unnail the shoots of *Peach* and *Nectarine* trees. Protect *Strawberries* in pots, and all fruit-trees intended for forcing. Dig fruit quarters where pruning is completed.



SLASHER,

The winner of many "running" races, and the sire of many winning horses.

CHAPTER VII.

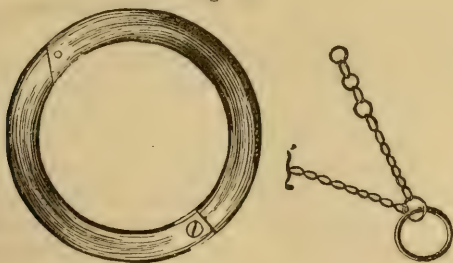
DOMESTIC OR FARM ANIMALS.

THE REARING, BREEDING, DISEASES, AND GENERAL CARE OF — THE BULL — THE OX — THE COW — SHEEP — SWINE — THE HORSE — THE ASS — THE MULE — THE GOAT — THE DOG — IN ALL THEIR STANDARD VARIETIES; — WITH A MONTHLY CALENDAR OF OPERATIONS.

I. HORNED OR NEAT CATTLE.

Breeding and Rearing. — The objects to be kept in view, in breeding cattle, are a form either well adapted to fatten, for producing milk, or for labor. These three objects have each of them engaged the attention of

Fig. 192.



agriculturists ; but experience has not altogether justified the expectation that has been entertained of combining all these desirable properties, in an eminent degree, in the same race. That form which indicates the property of yielding the most milk differs materially from that which we know, from experience, to be combined with early maturity and the most valuable carcass ; and the breeds which are understood to give the greatest weight of meat for the food they consume, and to contain the least proportion of offal, are not those which possess, in the highest degree, the strength and activity required in beasts of labor. A disposition to fatten, and a tendency to yield a large quantity of milk, cannot be united. The form of the animal most remarkable for the first is very different from that of the other ; — in place

of being flat in the sides, and big in the belly, as all great milkers are, it is high-sided and light-bellied,—in a word, the body of the animal well adapted to fatten is barrel-formed, while that of the milker is widest downwards.

Procreating Age.—The age at which bulls should be employed, and the number of seasons they should be allowed to serve, as well as the age at which the females should begin to breed, are points regarding which practice is by no means uniform. Sometimes the bulls are pretty commonly allowed to leap while yearlings, and, if good stock-getters, are kept on as long as they can serve,—perhaps till they are ten or twelve years old; in some places they are employed only three seasons, for the first time at two years old. The females, in many instances, bring their first calf at the age of two years, but more commonly, perhaps, not till they are a year older.

Period of Gestation.—The period of gestation with cows has been found to be about forty weeks. Cows seldom bring more than one calf at a time. When they produce twins, one of them a male and the other a female, the latter, which is called a free martin, is commonly considered incapable of procreation, though there are a few instances to the contrary.

Time of Impregnation.—The most desirable period for putting cows to the bull is midsummer, in order that they may be dropped in the spring, and have the whole of the grass season before them. Where no regular system is followed, and cows are sent to the bull merely because they are in heat, calves will be dropped at all seasons; but excepting when the fattening of calves is an object of importance, it is probably the most advantageous time, as the calves, having all the grass season before them, become sufficiently strong for enduring the change to a less agreeable food in the ensuing winter. A calf newly weaned seldom thrives well during that period, unless it is pampered with better food than usually falls to the share of young animals. By midsummer the cows are readier to take the bull than at any other season, and will bring calves in proper time. If a cow goes till after May before she calves, the calf will be too weak the winter following, and the dam will not be so ready to take the bull again, but will often grow barren.

Rearing.—The mode of rearing calves differs in different places. The best method, according to some, is this: The calves suck a week or a fortnight, according to their strength; new milk in the pail, a few meals; next new milk and skim-milk mixed, a few meals more; then, skim-milk alone; or porridge, made with milk, water, ground oats, &c., and sometimes oil-cake, until cheese-making commences, after which, whey porridge, or sweet whey, in the field; being careful to house them in the night, until warm weather sets in. This method of suckling is not, however, free from

objection ; and, in the ordinary practice of rearing calves, it is held to be a preferable plan to begin at once to teach them to drink from a pail. The calf that is fed from the teat must depend upon the milk of its dam, however scanty or irregular it may be ; whereas, when fed from a dish, the quantity can be regulated according to its age, and various substitutes may be resorted to, by which a great part of the milk is saved for other purposes, or a greater number of calves reared on the same quantity.

When fed from the pail, two gallons a day, for about three months, is enough ; but after it is three weeks old, it is best to give substitutes. When reared with skim-milk, it should be given about as warm as cow's milk when first drawn. If over-cold, the calves will purge, which, however, may be remedied by putting two or three spoonfuls of rennet into the milk.

When dropped during the grass season, calves should be put into some small home-close of sweet, rich pasture, after they are eight or ten days old, not only for the sake of exercise, but also that they may the sooner take to eating grass. When they are dropped in the winter, or before the return of the grass season, a little short, soft hay or straw, or sliced turnips, should be laid in the trough or stall before them.

The treatment of young cattle, from the time they are separated from their dams, or able to subsist on the common food of the other stock, must depend upon the farm on which they are reared. In summer, their pasture is often coarse, but abundant ; and in winter, all good breeders give them an allowance of succulent food along with their dry fodder. The first winter they have hay and turnips ; the following summer, coarse pasture ; the second winter, straw in the fold-yard, and a few turnips once a day, in an adjoining field, just sufficient to prevent the straw from binding them too much ; the next summer, tolerably good pasture, and the third winter, as many turnips as they can eat, and treated as fatting cattle.

Castrating.—There used to be a strange difference of opinion among farmers as to the time when this operation should be performed. In some places it is delayed until the animal is two years old : but this is done to the manifest injury of his form, his size, his propensity to fatten, the quality of his meat, and his docility and general usefulness as a working ox. The period which is now pretty generally selected is between the first and third months. The nearer it is to the last of the first month, the less danger attends the operation.

Mode.—Some persons prepare the animals by the administration of a dose of physic ; but others proceed at once to the operation when it best suits their convenience, or that of the farmer. Care, however, should be taken that the young animal is in perfect health. The mode formerly practised was simple enough :—a piece of whip-cord was tied as tightly as

possible around the scrotum. The supply of blood being thus completely cut off, the bag and its contents soon became livid and dead, and were suffered to hang, by some careless operators, until they dropped off, or were cut off on the second or third day. It is now, however, the general practice to grasp the scrotum in the hand, between the testicles and the belly, and make an incision on one side of it, near the bottom, of sufficient depth to penetrate through the inner covering of the testicle, and long enough to admit of its escape. The testicle immediately bursts from its bag, and is seen hanging by its cord.

The careless or brutal operator now firmly ties a piece of small string around the cord, and having thus stopped the circulation, cuts through the cord half an inch below the ligature, and removes the testicle. He, however, who has any feeling for the poor animal on which he is operating, considers that the only use of the ligature is to compress the blood-vessels and prevent after hemorrhage; and therefore saves a great deal of unnecessary torture, by including them alone in the ligature, and afterwards dividing the rest of the cord. The other testicle is proceeded with in the same way, and the operation is complete. The length of the cord should be so contrived that it shall immediately retract into the scrotum, but not higher, while the ends of the string hang out through the wounds. In the course of about a week, the strings will usually drop off, and the wounds will speedily heal. It will be rarely that any application to the scrotum will be necessary, except fomentation of it, if much swelling should ensue.

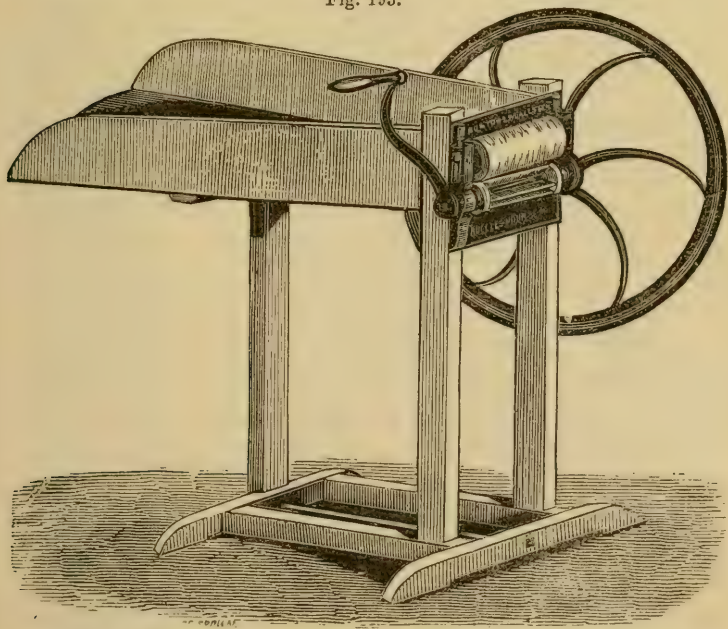
A few—but their practice cannot be justified—seize the testicle as soon as it escapes from the bag, and, pulling violently, break the cord, and tear it out. It is certain that when a blood-vessel is thus ruptured, it forcibly contracts, and very little bleeding follows; but if the cord breaks high up, and retracts into the belly, considerable inflammation has sometimes ensued, and the beast has been lost. This tearing of the cord may be practised on smaller animals, as pigs, lambs, and rabbits, as their vessels are small, and there is but little substance to be torn asunder; but, even there, the knife, somewhat blunt, will be a more skilful and humane substitute. This laceration should never be permitted in the castration of the calf or the colt.

The application of *torsion*, or the twisting of the arteries by means of a pair of forceps which will firmly grasp them, promises to supersede every other mode of castration, both in the larger and the smaller domesticated animals. The spermatic artery is exposed, and seized with the forceps, which are then closed by a very simple mechanical contrivance; the vessel is drawn a little out from its surrounding tissues, the forceps are turned round seven or eight times, and the vessel liberated. It will be found perfectly closed; a small knot will have formed on its extremity—it will retract

into the surrounding substance, and not a drop more blood will flow from it; the cord may be then divided, and the bleeding from any little vessel arrested in the same way. Neither the application of the hot iron or of the wooden claws, whether with or without caustic, can be necessary in the castration of the calf.

Fattening. — The common method of fattening *Calves* is, to allow them to suck, as by this method the object is probably not only sooner, but more effectually, attained, than by any other means. The period necessary varies from five to nine weeks, — the time being much shorter where milk is very valuable. Another method is, to give them the milk to drink, morning and evening, warm from the cow; the quantity being increased according to their age and strength. In whatever way they are managed, they should be kept in pens in a close house, and well littered, kept clean, and enjoy a due quantity of fresh air. Meal, linseed boiled into a jelly, and such like articles, are also given to calves while fattening.

Fig. 193.



The food on which *Cattle* are fatted is grass in summer, commonly on pastures, but sometimes on herbage cut and consumed in feeding-houses or

fold-yards; and in winter, on turnips, along with hay or straw, oil-cake, carrots, potatoes, &c. The hay or straw is much more beneficial when cut by one of the machines now used for that purpose.

The age at which cattle are fattened depends on the circumstance of their being employed in breeding, in labor, for the dairy, or solely for the butcher. In the latter case, the most improved breeds are fit for the shambles when about three years old, and very few of any large breed are kept more than a year longer. As to cows and working oxen, in most instances the latter are put up to feed after working three years, or in the seventh or eighth year of their age. In general, it may be said that the small breeds of cattle are fattened on pastures, though sometimes finished off on a few weeks' turnips; and large cattle, at least in some parts, are chiefly fattened in stalls or fold-yards, by means of turnips, and other like substances.

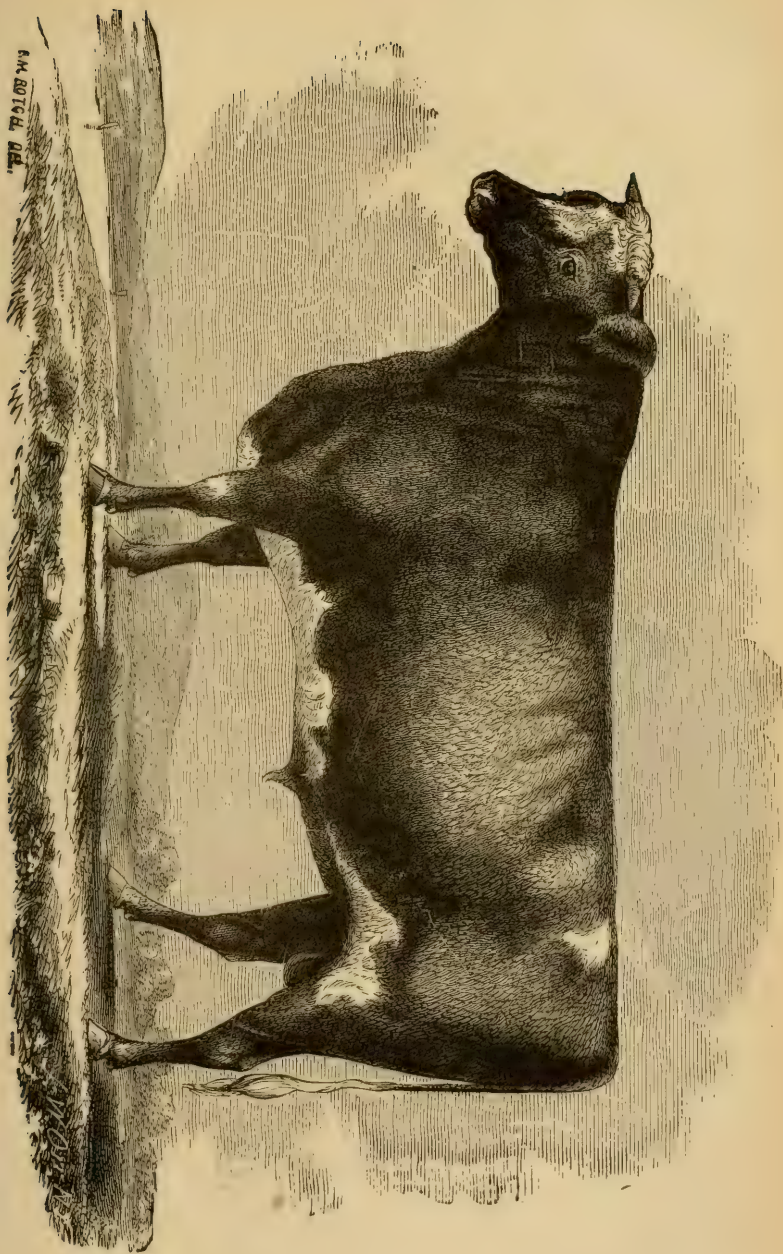
HOW TO JUDGE OF CATTLE FOR VARIOUS OBJECTS AND PURPOSES.

The Bull. — The head should be rather long, and the muzzle fine; eyes lively and prominent; ears long and thin; horns wide; neck rising with a gentle curve from the shoulders, and small and fine where it joins the head; shoulders moderately broad at the top, joining full to his chine or crops and chest backwards, and to the neck-vein forwards; bosom open; breast broad, and projecting well before his legs; arms, or fore-thighs, muscular, and tapering to his knee; legs clean, and very fine-boned; chine and chest so full as to leave no hollows behind the shoulders; plates strong, to keep his belly from sinking below the level of his breast; back, or loin, broad, straight, and flat; ribs rising one above another in such a manner that the last rib shall be rather the highest, leaving only a small space to the hips or hooks, the whole forming a round or barrel-like carcass; hips should be wide-placed, round, and a little higher than the back; the quarters, from the hip to the rump, long, tapering gradually from the hips backward, and the turls or pott-bones not protuberant; rumps close to the tail; tail broad, well-haired, and in a horizontal line with his back.

Bulls should be constantly well fed, and kept in proper enclosures.

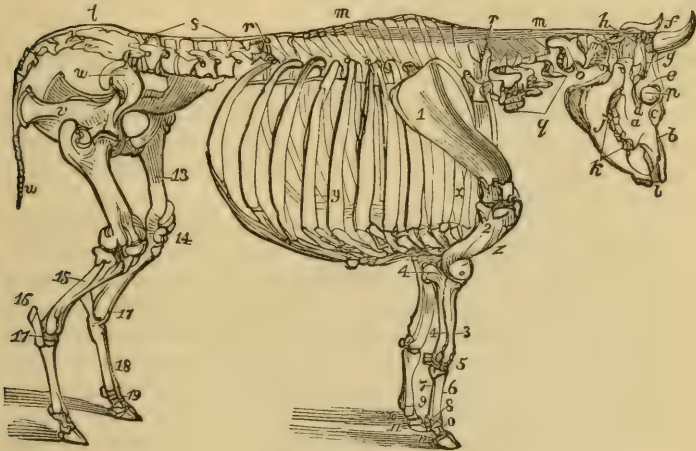
The Ox. — The head ought to be rather long, and muzzle fine; countenance calm and placid; horns fine; neck light, particularly where it joins the head; breast wide, and projecting well before the legs; shoulders moderately broad at the top, and the joints well in, and, when the animal is in good condition, the chine so full as to leave no hollow behind them; the fore flank well filled up, and the girth behind the shoulders deep; back straight, wide, and flat; ribs broad, and the space between them and the hips small; flank full and heavy; belly well kept in, and not sinking low in the middle; hips round, wide across, and on a level with the back

W. B. B. B. B.



itself; the hind quarters, that is, from the hips to the extremity of the rump, long and straight; the rump points fat, and coming well up to the tail; the twist wide, and the seam in the middle of it so well filled, that the whole may very nearly form a plane, perpendicular to the line of the back; the lower part of the thigh small; tail broad and fat towards the top, but the lower part thin; legs long and strong; feet and hoofs broad and hardy; and, when the animal is in fine condition, the skin of a rich and silky appearance.

Fig. 194.

*Skeleton of the Ox.*

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| <p><i>a</i>, The upper jaw bone.</p> <p><i>b</i>, The nasal bone, or bone of the nose.</p> <p><i>c</i>, The lachrymal bone.</p> <p><i>d</i>, The malar, or cheek bone.</p> <p><i>e</i>, The frontal, or forehead bone.</p> <p><i>f</i>, The horns, being processes or continuations of the frontal.</p> <p><i>g</i>, The temporal bone.</p> <p><i>h</i>, The parietal bone, low in the temporal fossa.</p> <p><i>i</i>, The occipital bone, deeply depressed below the crest or ridge of the head.</p> <p><i>j</i>, The lower jaw.</p> <p><i>k</i>, The grinders.</p> <p><i>l</i>, The nippers, found on the lower jaw alone.</p> | <p><i>m</i>, The ligament of the neck, and its attachments.</p> <p><i>n</i>, The atlas.</p> <p><i>o</i>, The dentata.</p> <p><i>p</i>, The orbit of the eye.</p> <p><i>q</i>, The vertebræ, or bones of the neck.</p> <p><i>r</i>, The bones of the back.</p> <p><i>s</i>, The bones of the loins.</p> <p><i>t</i>, The sacrum.</p> <p><i>u</i>, The bones of the tail.</p> <p><i>v</i> & <i>w</i>, The haunch and pelvis</p> <p><i>x</i>, The eight true ribs.</p> <p><i>y</i>, The false ribs, with cartilages.</p> <p><i>z</i>, The sternum.</p> <p><i>l</i>, The scapula, or shoulder-blade.</p> |
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| 2, The humerus, or lower bone of the shoulder. | 10, The two smaller pasterns to each foot |
| 3, The radius, or principal bone of the arm. | 11, The two coffin bones to each foot. |
| 4, The ulna, its upper part, forming the elbow. | 12, The navicular bones. |
| 5, The small bones of the knee. | 13, The thigh bone. |
| 6, The large metacarpal or shank bone. | 14, The patella, or bone of the knee. |
| 7, The smaller or splint bone. | 15, The tibia, or proper leg bone. |
| 8, The sessamoid bones. | 16, The point of the hock. |
| 9, The bifurcation at the pasterns, and the two larger pasterns to each foot. | 17, 17, The small bones of the hock. |
| | 18, 18, The metatarsals, or larger bones of the hind leg. |
| | 19, 19, The pasterns and feet. |

The Cow. — Wide horns; head and neck thin; dewlap large; full breast; broad back; large, deep belly; the udder capacious, but not too fleshy; the milk-veins prominent, and the bag tending far behind, teats large and long; buttocks broad and fleshy, tail long and pliable, legs in good proportion, and the joints short. To these may be added a gentle disposition, and free from vicious tricks.

Age of Cattle. — This is determined by the teeth and horns. At the end of about ten years, they shed their first four teeth, which are replaced by others, larger, but not so white; before five years, all the incisive teeth are renewed. These teeth are at first equal, long, and pretty white; but, as the animals advance in years, they wear down, and become unequal and black. These animals likewise shed their horns at the end of three years, and are replaced by other horns, which, like the second teeth, continue. The manner of the growth of these horns is not uniform, nor the shooting of them equal. The first year,—that is, the fourth year of the animal's age,—two small pointed horns make their appearance, neatly formed, smooth, and towards the head terminated by a kind of button. The following year this button moves from the head, being impelled by a horny cylinder, which, lengthening in the same manner, is also terminated by another button; and so on, for the horns continue growing as long as the animals live. These buttons become annular joints or rings, which are easily distinguished in the horns, and by which the age of the creature may be easily known,—counting three years for the point of the horn, and one for each of the joints or rings. The cow is useful for twenty years,—much longer than the bull.

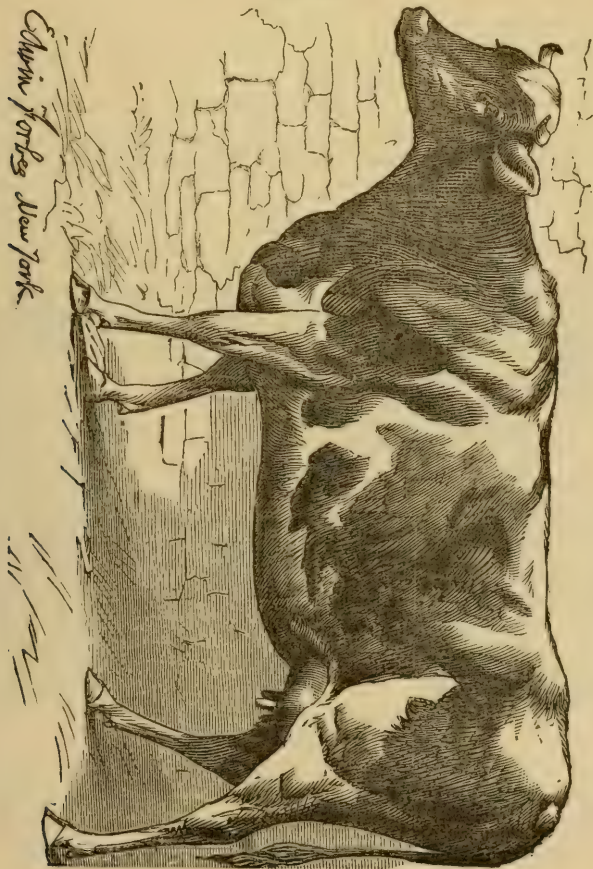
Names of Cattle at Different Ages. — A young castrated male, after the first year, is called a stot, stirk, or steer; at five years old, an ox. A female, after the first year, is called an heifer, or quey; at five years old, a cow; and afterwards a castrated female is called a spayed heifer or cow. Bullock is the general term for any full-grown cattle, male or female, fat or lean.

DIFFERENT BREEDS.

NATIVE.—Our best cattle are more or less mixed with standard breeds ; but of which no record has been kept. We here give a specimen (Fig. 195) of an almost perfect cow. This cow gave thirty-eight and a half quarts per day.

In the Eastern and Middle States the ruling qualities of the North Devon stock are quite perceptible. The cattle average well. The oxen are good under the yoke and the cows good milkers. By means of this stock and imported bulls the cattle of the Western and Middle States are

Fig. 195.

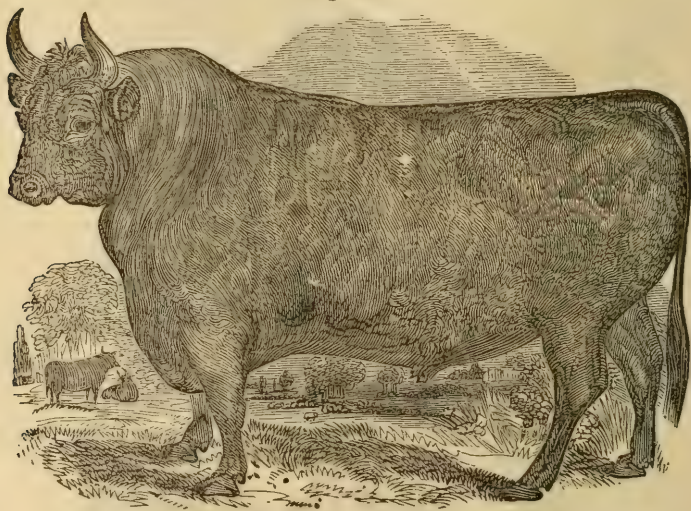


being vastly improved. In the West, the short-horned animals have been generally preferred, but the Durhams are now coming into vogue very extensively, on account of their superior adaptedness to travel to the Eastern markets without sensibly deteriorating in weight and quality. The English Herefords are now being paid particular attention to, as they are supposed to be well calculated for the Western graziers; the West Highland breed is also recommended.

DEVON.—The true Devon cattle are gentle, agile, and peculiarly adapted to active labour. Their shoulders have that obliquity which enables them to lift freely their fore extremities; and their quarters behind are relatively long, a characteristic connected with the power of active motion. Their bodies, too, are light, and their limbs long, muscular to the hock and knee, and below these joints sinewy. They have the faculty of muscular exertion in a high degree, trot well in harness, and will keep pace with a horse in the ordinary labors of the farm.

Devon Bull.—The figure below represents a fine specimen of a genuine

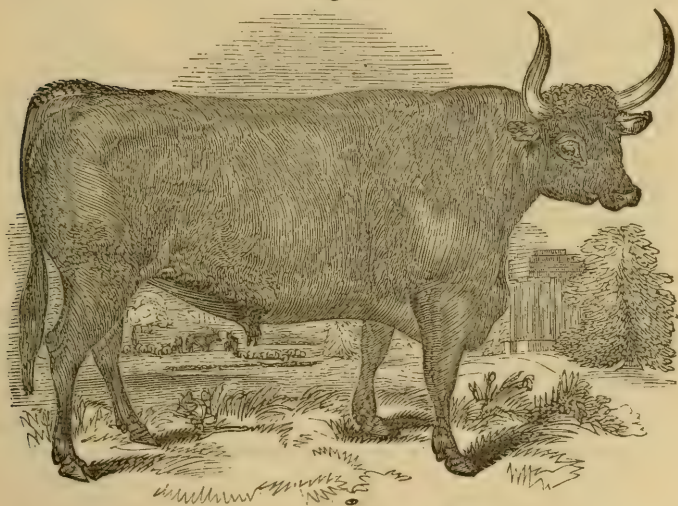
Fig. 196.



Devon bull. The horn of the Devon bull ought to be neither too low nor too high, tapering at the points, not too thick at the root, and of a yellow or waxy color. The eye should be clear, bright, and prominent, showing much of the white, and it ought to have around it a circle of a variable color, but

usually a dark orange. The forehead should be flat, indented, and small, the purity of the breed being very much determined by the latter characteristic. The cheek should be small, the muzzle fine, the nose clear yellow, the nostril high and open, the hair curled about the head, and the neck quite thick. Excepting in the head and neck, the form of the bull does not materially differ from that of the ox, but he is considerably smaller. There are some exceptions, however, to this rule, as the two figures which follow indicate, these representing the offspring of the bull exhibited in Fig. 196.

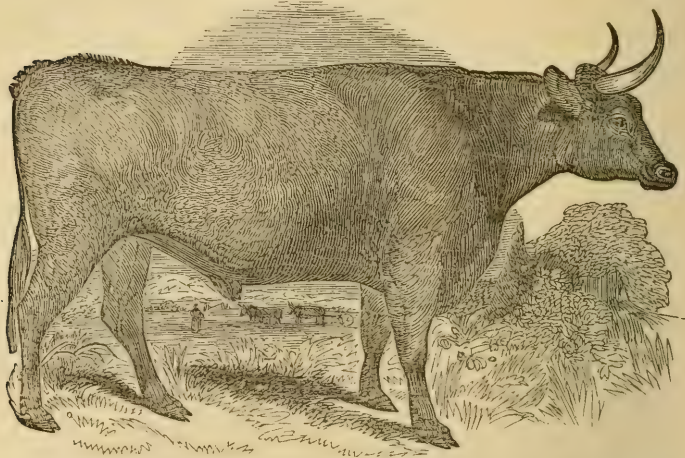
Fig. 197.



Devon Ox.—The head of the Devon ox is quite small, with a great breadth of forehead; clean and free from flesh about the jaws; prominent eye; vivacious countenance; long and thin neck; light in the withers; the shoulders a little oblique; breast deep; bosom open and wide; fore-legs wide apart; the point of the shoulder rarely seen; no projection of bone, as in the horse, but a kind of level line running on to the neck; skin, notwithstanding the curly hair, exceedingly mellow and elastic; color a blood red, which is usually indicative of purity of breed, though there are many animals, of great excellence, of a chestnut hue, and even bay brown. Those of a yellowish hue are said to be subject to *steal* (diarrhœa). The preceding figure is an accurate likeness of an ox beginning to fatten, but his character-

istic points not yet concealed. The cut below is that of a working Devon ox, embodying almost all the good points which have been enumerated.

Fig. 198.



A selection from the most perfect animals of the true breed, — the bone still small and the neck fine, but the brisket deep and wide, and down to the knees, and not an atom of flatness all over the side, — or one cross, and only one, with the Hereford, and that stealthily made, — these have improved the strength and bulk of the Devon ox, without impairing, in the slightest degree, his activity, beauty, or his propensity to fatten.

Fig. 199.

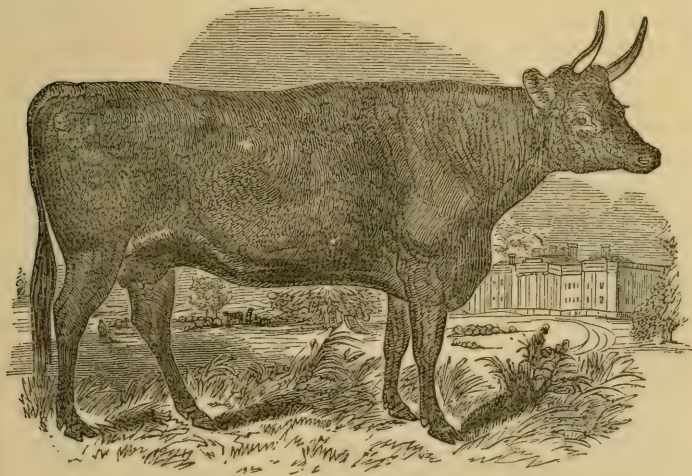


Devon Cow. — 'There are few things more remarkable about the Devonshire cattle than the comparative smallness of the cow. The bull is a great deal less than the ox, and the cow almost as much smaller than the bull. This is somewhat of a disadvantage, on the whole, a *roomy* cow being very desirable for breeding. But, though small, the Devon possesses that roundness

and projection of the last two or three ribs, which renders it more roomy than a careless examination would lead one to suppose. She is particularly distinguished for her full, round, clear eye, the gold-colored circle around the eye, and the same color prevailing on the inside skin of the ear; countenance cheerful, the muzzle orange or yellow, but the rest of the face having nothing of black, or even white, about it; jaws free from thickness, and the throat free from dewlap. The points of the back and the hind quarters differ from those of other breeds, having more roundness and beauty, and being free from most of those angles by which good milkers are sometimes distinguished.

The following is a portrait of a Devon cow, rising four years old. With

Fig. 200.



regard to size, she is a favorable specimen, and it will be seen at once how much more roomy and fit for breeding she is than even her somewhat superior bulk would at first indicate. She is, perhaps, in a little better condition than cows generally are, or should be, in order to yield their full quantity of milk.

REMARKS. — The qualities of the Devon cattle may be referred to three points — their working, fattening, and milking.

Where the ground is not too heavy, the Devonshire oxen are unrivaled at the plough. They are quick, active, docile, and capable. They are usually taken in to work when about two years old. If kept idle till five

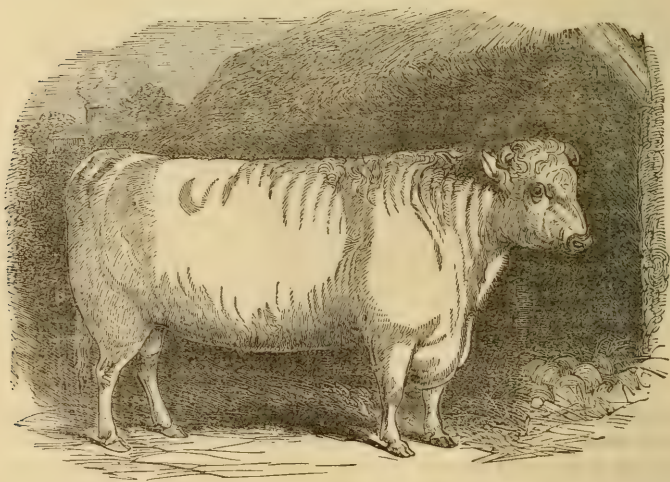
or six years of age, they will be stunted in growth. At six to six and a half, they reach their full stature. At nine years, or older, they decline in value.

With regard to their disposition to fatten, they have few rivals here. They do not, indeed, attain the great weight of some breeds, but, in a given time, they acquire more flesh, and with less consumption of food; and their flesh is beautiful in its kind, pleasing to the eye, and to the taste.

For milking, the Devons are inferior to several other breeds. The milk is good, yielding more than an average proportion of cream and butter, but it is deficient in quantity. Some, however, deny that the latter is true.

DURHAM, OR SHORT-HORN.—The short-horned, sometimes called the Dutch breed, is known by a variety of names, such as the Holderness, the Teeswater, the Yorkshire, Durham, Northumberland, and others. Applying the points of judging live-stock to the short-horns, it is found, that for quantity and well-laid-on beef, the short-horned ox is quite full in every valuable

Fig. 201.



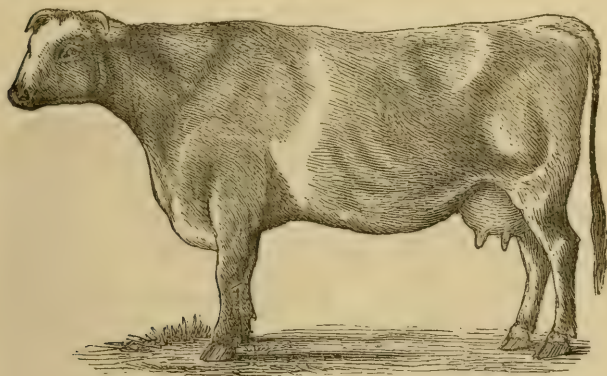
part. In regard to quality of beef, the fat bears a due and even predominating proportion to the lean, the fibres of which are fine and well mixed, and even marbled with fat, and abundantly juicy. The fine, thin, clean bones of the legs and head, with the soft, mellow touch of the skin, and the benign aspect of the eye, indicate in a remarkable degree the disposition to fatten; while the uniform colors of the skin, red or white, or both combined in

various degrees, mark distinctly the purity of the blood. They are at once distinguished from any of the other breeds by their additional size, and their more square and massy form. Their bones are exceedingly small, compared with the size of the animal; their skin possesses that peculiar touch so characteristic of a good feeder; they arrive early at maturity; and, further, they combine the valuable qualities of milking and fattening in an unsurpassed degree.

Fig. 201 exhibits one of the truest specimens of Short-horned bulls, and may be relied on for its faithful delineation.

The Short-horned cow gives a large quantity of milk, and is, in all respects, a superior animal. Having given some account of the excellent qualities distinguishing the breed generally, we close with presenting a likeness of one of the female species.

Fig. 202.



HEREFORDSHIRE. — The Herefordshire white-faced breed may be thus distinguished: The countenance cheerful, pleasant, open; the forehead broad; eye full and lively; horns bright, taper, and spreading; head small; chap lean; neck long and tapering; chest deep and full; bosom broad, and projecting forward; shoulder-bone thin, flat, full, and mellow in flesh; loin broad; hips standing wide, and level with the chine; quarters long, and wide at the neck; rump even with the level of the back, and not drooping, nor standing high and sharp above the quarters; tail slender and neatly haired; barrel round and roomy; the carcass throughout deep and well-spread; ribs broad, standing flat and close on the outer surface, forming a smooth, even barrel, — the hindmost large and full of length; round bone small, snug, and

not prominent ; thigh clean, and regularly tapering ; legs upright and short below the knee, and hock small ; feet of middle size ; flank large ; flesh everywhere mellow, soft, and yielding pleasantly to the touch, especially on the chine, the shoulder, and the ribs ; hide mellow, supple, of a middle thickness, and loose on the neck and huckle ; coat neatly haired, bright and silky ; color a middle red, with a bald face, characteristic of the true breed. They fatten to a much greater weight than the Devons, and at an early age. They are far worse milkers, however, than the latter, but will thrive and grow fat where a Devon would scarcely live. A cross of the Devon and Hereford will often improve each other, the former acquiring bulk and hardihood, and the latter a finer form and activity.

The Hereford cow (Fig. 203) is apparently a very inferior animal. Not only is she a poor milker, but her form is defective,—small, delicate, and ill-made. She is very light-fleshed when in common condition, and

Fig. 203.

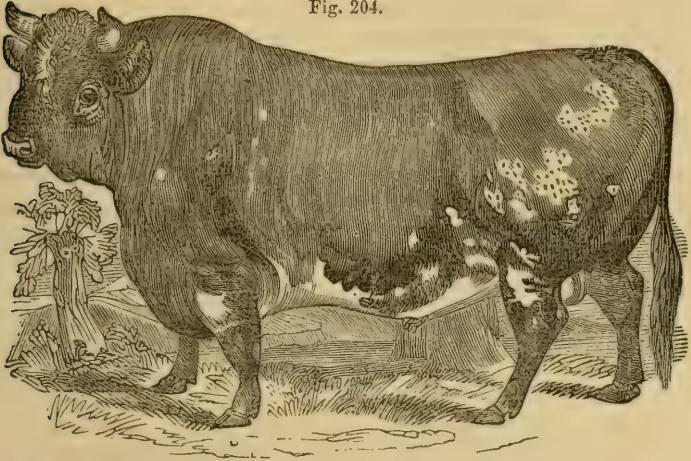


beyond that, while she is breeding, she is not suffered to proceed ; but when she is actually put up for fattening, she spreads out, and accumulates fat at a most extraordinary rate.

The Hereford ox fattens speedily at a very early age, and it is therefore generally more advantageous that he should go to market at three years old than be kept longer to be employed as a beast of draught.

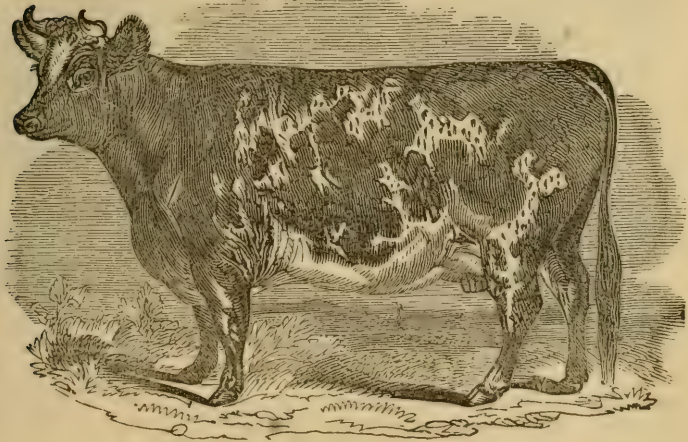
AYRSHIRE.—This breed has been much improved. It is short in the leg, the neck a little thicker at the shoulder, but finely shaped towards the head ;

Fig. 204.



the horns are smaller than those of the Highland breed, but clear and smooth, pointing forwards, and turning upwards, tapering to a point.

Fig. 205.



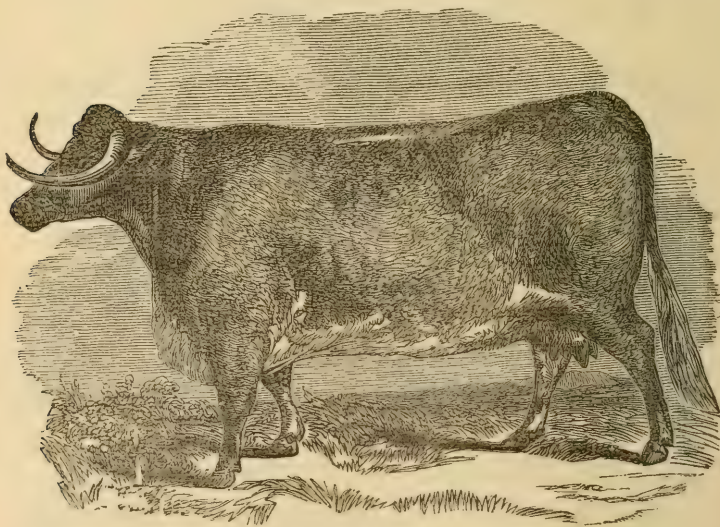
They are deep in the carcass, but not round and ample, and especially not so in the loins and haunches. Fig 204 represents an improved Ayrshire bull.

It is said that the Ayrshire farmers prefer their dairy bulls according to the feminine aspect of their heads and necks, and wish them not round behind, but broad at the hook-bones and hips, and full in the flanks.

The Ayrshire cow is a valuable dairy cow, the quantity of milk yielded by her being very great, considering her size. Five gallons daily, for two or three months after calving, may be considered as not more than an average; three gallons daily will be given for the next three months, and one gallon and a half during the succeeding four months. Three gallons and a half of this milk will yield about a pound of butter; thus fully establishing the reputation of the Ayrshire cow, so far as the dairy is concerned. Fig. 205 represents one of these beautiful animals.

NEW LEICESTER. — This breed may be substantially distinguished by the following characteristics: The fore end long, but light to a degree of ele-

Fig. 206.



gance; neck thin; chap clean; the head fine, but long and tapering; eye large, bright, and prominent; the horns of the bulls comparatively short, of the oxen extremely long, as are, also, those of the cow, and most of them

hang downward by the side of the cheeks ; shoulders fine and thin as to bone, but thick as to flesh, without any protuberance of bone ; girth small, compared with the short-horns and middle-horns ; chine quite full when fat ; loin broad, hip quite wide and protuberant ; quarters long and level, the *nache* of a middle width, and the tail set on variously ; round bones small, but thighs fleshy, tapering ; legs small, clean, somewhat long ; feet neat, middling size ; the carcass as nearly a cylinder as the natural form of the animal will allow ; ribs standing out full from the spine ; belly small ; hide middling thick ; color various, — the brindle, the finch-back, and the pye, are common. The fattening quality, when the breed is in a state of maturity, is indisputably good. As grazier's stock, they rank high. The principle of the utility of form has been strictly attended to. As dairy stock, their merit is less evident. As beasts of draught, many of them are sufficiently powerful, and are more active than some other breeds used for the plough, or on roads ; but their horns form something of an objection to such use of them. Fig. 206 is that of a New Leicester cow.

REMARKS. — Some of the other most noted breeds, which are coming into extensive favor in this country, are the Holderness, the Galloway, the Sussex, the Alderney, the Suffolk, and the Kyles ; these, however, we do not design to notice in detail, but shall close our notes on neat cattle with a few remarks on some of the characteristics and general management of

DAIRY COWS.

Qualities. — We have already expressed, in the preceding pages, the general opinions entertained as to the adaptedness of particular breeds for dairy purposes.

Where butter is the main object, such cows should always be chosen as are known to afford the best and largest quantities of milk and cream, of whatever breed they may be. But the quantity of butter to be made from a given number of cows must always depend on the size and goodness of the beasts, the kind and quantity of food, and the distance of time from calving. The form of animals that are best fitted to arrive at early maturity and secrete fat, differs in some respects from that which indicates a disposition to secrete and yield milk. A dairy cow, like a feeding animal, should have a skin soft and mellow to the touch, — should have the back straight, the loins broad, the extremities small and delicate ; but she need not, as in the case of the feeding animal, have the chest broad and prominent before. She should rather have the fore-quarters light, and the hind-quarters relatively broad, capacious, and deep ; and she should have a large, well-formed udder. There should be no breeding *in-and-in*, as in the case of a feeding stock. The purpose in rearing cows for the dairy is not to pro-

duce animals that will arrive at premature age, but such as are hardy and of good constitution. By long attention to the characters that indicate a disposition to yield milk, the breed of Ayrshire has become greatly more esteemed for the dairy than other animals much superior to them in size and feeding qualities.

Feeding. — With respect to the manner of feeding dairy cows, the most economical, perhaps, is feeding them entirely on green forage during the summer, and on roots in winter. But, as to the effect of food, notwithstanding all that may justly be said respecting the nutritive properties of peculiar roots and artificial grasses, no food can excel that of good natural pastures, for milch cows; for not only do they yield a greater quantity of milk when fed on pastures, but the flavor of grass butter may always be distinguished, by its superior richness and delicacy, from that which has been made from milk produced from soiling in the house. This, however, should not deter the farmer from feeding his dairy stock in that manner, for the difference in the quality of the produce is not so great as to counterbalance the many advantages resulting from a due extent and proper kind of soiling. But in a country where cultivation has not been carried to its fullest extent, and a considerable proportion of the land is necessarily devoted to the production of grass, the cows may be kept, with great advantage, on the pastures, during summer.

Keeping in Good Condition. — Dairy cows should be kept constantly in good condition. When they are suffered to fall off in flesh, particularly in the winter season, it is impossible that they can be brought to yield a large quantity of milk, by getting them into better condition in the summer months. When cows are lean at the period of calving, no management afterwards is capable of bringing them to afford, for that season, anything near the proportion of milk they would have yielded if they had been supported in proper condition during the winter. Food of the most nourishing and succulent kinds should, therefore, be regularly given, in suitable proportions, in the cold, inclement months, and they should be kept tolerably warm, and well supplied with pure water. It will be equally conducive to the health of cows as to that of feeding cattle, to comb them regularly, and to make such other arrangements as are conducive to cleanliness.

Milking. — In summer, the cows are milked in the field, or they are driven gently home to their stalls, and milked there. The cows, when in full milk, should be milked three times a day, and, at other times, twice in the day will suffice. On the physiological principle of the secretions of animals being increased in proportion as the secreted fluid is more frequently withdrawn, the propriety of frequent milkings is apparent, in order to increase or maintain the supply of milk produced by cows. There can be

FINE JERSEY COW.

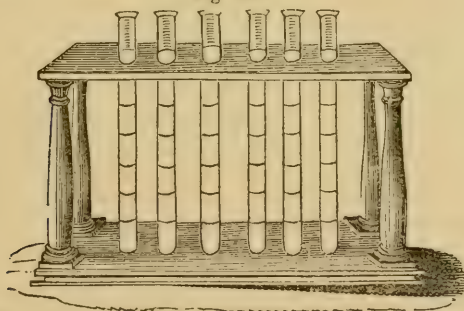


little doubt but that, by accustoming the secretory organs to more frequent action, such a habit may be established in them as will afford a larger proportion of milk in a given time. But, in order to effect this in the most perfect manner, it will be necessary to have the cows highly fed, to observe the greatest regularity and exactness in the hours of milking, and to be careful that every drop of milk is drawn away each time. If any milk is allowed to remain in the udder after the operation of milking, it is well ascertained that the cow will yield a smaller quantity at the next milking.

A milch cow is usually considered in her prime at five years old, and will generally continue in as good milking state until ten years old, or upwards, depending much on the constitution of the animal, — some cows, like other animals, exhibiting symptoms of old age sooner than others.

Ascertaining the Quality of Milk. — The value of milk, and the proportion of either butter or cheese that it produces, depends much upon its quality. As the milk of some cows is so greatly superior to that of others, where regularity is observed, it is important that the milk of each should be placed by itself until its quality is ascertained. This is effected by churning it separately; but a more expeditious and convenient method is to ascertain its strength by means of the lactometer, an instrument which we have described in the chapter on the dairy, and a cut of which we annex.

Fig. 207.



Grazing Cattle. — Fattening cattle for sale being an important branch of agricultural economy, the farmer should regulate his system of grazing by his knowledge of the nature and fertility of his pastures. Those beasts only should be selected, which show a disposition to fatten on the smallest amount of food, and it will be advisable to pasture them on lands suited to their different breeds. It is a bad practice to transfer cattle from rich to inferior soils: the reverse should be the rule; and graziers would do

well by selecting their purchased stocks from lands of a poor quality. Water has also its effect upon cattle, which, if removed from pastures well supplied with sweet water to those not well furnished with that requisite, will not only fail to improve, but will rapidly deteriorate. In order to render the grazing of cattle profitable, they should be gradually changed from inferior pastures to others covered with more choice grass; cattle being very fond of variety, they will eat only the best portions of the grass, fill themselves speedily, and lie down to chew the cud and digest their meal at leisure. This mode of feeding tends greatly to increase of fat. It is important not to overstock the pastures, and strong cattle should be separated from weaker ones; as the more powerful animals frequently drive the others around the field, much to the injury of the grass, and the annoyance of non-resisting animals. If there are no trees in the field, the erection of rubbing-posts will prevent the cattle from injuring the fences by using them for that purpose.

Many highly intelligent graziers recommend a division of the grazing farm into four enclosures; each containing a nearly equal quantity of land. One of these enclosures being kept entirely free from stock until the grass has attained its full growth, the prime, or fattening cattle, are then turned into it, in order that they may cull the choice food; the second best then follow these; and the young stock next in order. Thus the entire herd will feed over the four enclosures in succession—the first being kept free from stock until ready for the best cattle—the second is appropriated to the best cattle until they are sent to No. 1—the third is pastured by the second best cattle until they are turned into No. 2—and the fourth is devoted to the young cattle until they are sent to No. 3. Sheep follow after the young cattle, and crop the grass down to a close and even sward; after which this enclosure is shut up until again ready for the prime cattle. It is likewise advisable to divide the fattening enclosure by hurdles, by which means the stock may be confined to one-half of it at a time, and thus be continually furnished with good, fresh pasture.

Winter stall-feeding.—Two modes are practised by farmers: 1. Confinement in stalls; 2. Confinement in small yards, with open sheds attached. Each shed, together with its yard, has a sufficient capacity for two oxen, and is surrounded by a well-built wall, against which, in the yard, the feed-troughs are placed. If the cattle are confined to the stall, they require to be fastened with care the first time; and they must be watched for a time to prevent them from injuring themselves by struggling to get loose, as is occasionally the case. They must also be well and comfortably littered, and the feed placed before them in a low manger.

Early each morning the dung must be removed from the stalls, and the mangers be filled with roots first, and subsequently with well-cured hay. At noon, feed as before; again, before night sets in; and, if practicable, previous to retiring for the night, stir up the litter, examine whether all is right, and put more food before them. By pursuing this plan, the cattle will be well fed, and, during the intervals between meals, will lie down and rest. Currying has also a beneficial effect upon cattle, and their hides should be carefully freed from vermin and other impurities. Comfortable accommodations, good ventilation, regularity in feeding, as well as in the amount of food given, good and abundant litter, attention to cleanliness, and an unstinted supply of pure water, are all desiderata in the fattening of cattle, which cannot be too carefully attended to by those who have charge of them. Nothing conduces so much to the fattening of animals as perfect quiet; and every means should be used to promote rest, ease, and contentment. Formerly, cattle were fattened entirely on hay; but this having been found not only a tedious, but also an expensive mode, oil- and rape-cake have been largely substituted, and almost every variety of esculent. The ruta-baga and sugar-beet are, however, preferable to any others of the root-tribe, not only on account of the quantity of contained nutriment, but also because they are relished by the cattle, which thrive upon them in an extraordinary degree. The modern practice of cooking roots for the use of cattle, is much facilitated by the employment of various steaming apparatus. Many experiments have been made to test the relative nutritive qualities of raw and cooked food. The results prove that cooked roots and grain are not more nourishing than when fed to cattle in the raw state; but cooked food being more easily digested, the animals fed on it are enabled to consume a larger quantity, and in this way benefit by its use. Ruminant animals, however, profit less from being fed on it, than do those of the non-ruminant class, as the horse, the hog, &c. The use of grain will, in a great measure, depend upon the market-price; but the practice cannot be recommended, unless called for by peculiar circumstances, such as a scarcity, or a diseased condition, of esculent roots.

II. SHEEP.

Rearing, &c. — The ewe may breed when fifteen or eighteen months old, and at the same age the ram may also be employed to the extent of forty or fifty ewes, and, when older, to seventy or eighty.

The young lambs should be brought forth at a time when there will be a sufficient supply of food for the dam to enable her to yield a copious supply of milk; and also for the lambs, as they advance in growth. The usual

period is from the middle of October to November, in which case the ewes will begin to lamb soon after the beginning of March. No preparation is necessary, except, for a few weeks before, to place the ewes on somewhat better pasture than usual.

The period of lambing having commenced, the attendant should carefully observe every ewe that appears to be in labor. The attendant should not be in haste to render assistance, until the strength of the ewe appears to be declining. If she is to be driven to the fold, it must be done gently as possible. Before assistance is given, first see that the fœtus is coming in a proper position, which is with the head crouched between the fore-legs; if wrong, it must be turned to the proper position. In the case of twin lambs, the one which is least advanced must be put back, and the extraction of the other assisted. If the fœtus be dead, it should be extracted immediately.

The keep of sheep after lambing, when rich pastures, or other kinds of grass lands, cannot be reserved, should consist of turnips, or other kinds of green food. The ewes should also have a dry, quiet, and sheltered pasture, protected from the severity of the weather. High feeding should be allowed them, but not while pregnant.

Castrating. — Castration of the male lambs should be performed when they are ten days or a fortnight old. They should be in perfect health, and the weather fine, but not warm. An incision is made into the scrotum on each side, through which the testicles are successively protruded, and they are taken away by severing the spermatic cord.

Weaning. — The period of weaning differs according to the locality of the farm, and the quality of the pasture. In a mountainous situation, and where the land is inferior, weaning often takes place when the lambs are not more than three months old, for it requires all the intermediate time to the beginning of winter to bring the ewes either ready for the ram or fatted for the market. The time is generally from the first to the middle of July, and the lambs are simply separated from the ewes. It is necessary to take away a portion of the ewe's milk, at intervals, to prevent injurious distension of the udder. Dry them by degrees.

After being weaned, the lambs are named according to their sex and age. The males are called hoggets, or hogs, the rams being termed tup-hogs, the castrated males wether-hogs, and the ewes ewe-hogs.

It is important that the lambs be put into a good pasture in the summer, to make up for the loss of the milk of the dam. When the grass begins to fail, they are to be supplied with turnips plentifully, which, with hay, are to be their food during winter.

Shearing. — This is an annual operation, usually taking place at the end of May or first of June, — the precise period depending on the state of the

animals, those in a high condition being ready sooner than those that are lean, — the wool coming off readily at that time, when plucked, this being the proper criterion. About a week previously to shearing, the animals are to be washed, to free the wool from all impurities. Everything being prepared, a sheep is handed to the first operator, who seizes it and pulls it into the water, and immediately turns it over on its back, holding the arm of the fore-leg with the left hand, and grasping a portion of the wool at the side of the head with his right hand, turning the sheep over from side to side, at the same time pulling it gently backwards and forwards from and to him, at every successive turning; the wool waves up and down in the direction of the length of the body, and swirls round the body, first in one direction and then in another; the sheep is then handed to another operator, who repeats the process and hands the animal to another person, and he who handles it last examines the fleece.

After being washed, the sheep are put into a clean grass field; the fleece will soon dry, after which the sheep may be shorn; though it is better to wait about a week, in order that the oil may be brought again into the wool, without which the latter loses its peculiar lustre with the loss of the yolk.

When the sheep are to be shorn, they are put into some enclosed space; a winnow-cloth, or large sheet, of some kind, is spread on the floor, and fastened down at the corners. The shearer then sets the sheep on its rump, in which position it is kept by resting against his legs. In this position, the wool is removed from the head and neck, and the operator afterwards clips in a circular direction from the belly to the back; the animal is then laid on its side, and kept down by the leg of the shearer, who clips the fleece all around the back. All dirty portions of the wool about the tail and belly ought to be removed by the shears, and kept by themselves. The outside of the fleece is folded inwards, beginning with the side, and narrowing the whole fleece into a stripe of about two feet in breadth. This stripe is then rolled firmly up, from the tail-end towards the neck, the wool of which is stretched out and twisted into a rope, and wound around the fleece, to give it a cylindrical shape. The clippings are steeped in water and washed by the hand, and afterwards dried in the sun.

In using the shears, they should be held close to the sheep, with their points a little elevated; every stroke should be short and narrow, to make a clean clip. Keep the shears sharp by a whetstone.

Different names are again applied to the sheep after being shorn. They are now shearlings, shearling-wethers, shearling-ewes, and shearling-tups or rams; the wethers are also called dinmonts, and the ewes gimmers.

The ewes, or gimmers, are kept on the pastures during the second season

and such as are intended for breeders receive the ram at the proper season. The wethers, or dinmouts, are fit for the butcher soon after being shorn. But it is only in the case of the more improved breeds being reared, and the supply of food of the last description, that the dinmouts are thus disposed of at this early period. More frequently they are kept on the farm for another winter, when the management is the same as during the first year. The dinmouts, however, are frequently sold fat before they have completed the entire winter's feeding; and when not disposed of at this period, they are sold after being a second time shorn.

The details of the rearing and treatment of sheep on arable farms have now been given at length. But frequently, instead of the animals being produced and fattened on the farm, the operations of the farmer may be either confined to breeding sheep and disposing of them before they become fat, to pass into other hands before they come to the butcher, or they may be confined to fattening sheep, always purchasing the stock from the breeder. In situations, however, where the breeding and feeding of sheep can be carried on with equal advantage, they may, with economy, be combined on the same farm.

Animals for the Market. — But instead of rearing all the animals to the age of one or two years, the lambs are sometimes disposed of fat during the first summer. In this case, they are fattened merely on the milk of their dams. In certain cases, however, the ewes are made to produce the lambs at those seasons which are found to suit the adjacent markets best, and the lambs are fed in the house.

Food. — Grass in summer, and turnips and hay in winter, form the chief food of sheep, and they are seldom difficult to procure in favorable situations. In the absence of turnips, the different roots cultivated on the farm may be substituted with advantage. Salt should always be supplied to sheep.

Sheep in Mountainous Sections. — The management of sheep in mountainous sections sometimes differs, in some respects, from that described. The food is here not so abundant, nor so good, and the sheep must be of hardy constitution. The period of putting the ram to the ewes is also somewhat later, in order that the lambs may not be brought forth until the season is advanced, and the herbage well sprung up. During the winter, when not too severe, the sheep are kept on the pasture, and in stormy weather they have an allowance of hay, and roots when they can be produced. The operations of lambing, castrating, weaning, and shearing, are the same in both cases.

Smearing. — The operation of smearing may be regarded as peculiar to the mountain races of sheep. This is performed with a view to destroy the

vermin, and protecting the animals from the inclemency of the weather. It is, however, injurious to the wool, but doubtless destroys vermin, and prevents diseases of the skin. The usual substances employed are tar and butter,—a gallon of the former to six pounds of the latter,—which is sufficient for twenty sheep. Combinations of tar with other substances are also employed, such as oil, soda, and even potatoes boiled and pounded, the effect of which is to render the tar more easy of separation from the wool. Whatever composition is used, it should be rubbed in streaks on the skin, without daubing the wool. The usual time of doing it is in the first part of November.

Signs of Good Health.—The appearances which show the sheep to be in good health are, a rather wild or lively briskness; a brilliant clearness in the eye; a florid, ruddy color on the inside of the eyelids, nostrils, and gums; a fastness in the teeth; a sweet breath; a dryness of the nose and eyes; easy and regular breathing; coolness in the feet; dang properly formed; fleece firmly attached to the skin, and unbroken; and the skin exhibiting a florid-red appearance. A discharge from the nose or eyes indicates having taken cold.

Improvement of Breeds.—In selecting a breed of sheep the farmer should be governed by the nature of his pasture-lands, and the means he has at command for supplying them with prepared food. A mountain breed will not prove profitable upon a valley farm; nor will a lowland breed of sheep thrive well on hill-side pastures. After selecting a breed, the next point for careful attention is the propagation of lambs; for which purpose the best sheep in the flock should be selected. Early maturity and a disposition to acquire fat are of importance when meat only is the object sought; but these qualities are of secondary importance to the wool-grower, who looks rather to the fine texture of the fleece, the hardy nature of the animals, and their healthy condition. Breeding-in should be practised only to a moderate extent, as, when carried too far, it tends to make the sheep sickly and delicate. When unduly practised, Nature rebels against it; the sheep cease to produce wool in sufficient quantity, the ewes stop giving milk, and the rams lose their virility. Crossing with the best breeds of another stock is the only remedy in cases of this kind; which is a matter of easy accomplishment, since there is a plentiful supply of superior rams in all of the breeds now reared.

Form.—Proneness to acquire fat at an early age may be distinguished by certain external characteristics, as may also the wool-bearing qualities, which are of such great importance to the breeder. A disposition to fatten is indicated by general rotundity of form, small bones, well-arched

ribs, and broad, flat, and straight back and loins. The body should be proportionally larger than the limbs, the chest well set, the belly straight, the head small, and the ears thin. The legs should be fleshy to the joint; thence tapering downward, delicate, and covered with short hair; the wool soft-feeling, thick, and growing well forward on the face, but not covering it; the skin soft, and elastic to the touch; the face and forehead thickly covered with short hair; and the eyes clear and bright.

Age may be ascertained by examining the front teeth, which are eight in number, and make their appearance during the first year, when they are all of small size. The following year the two middle teeth are superseded by two others of larger size. During the third year, two other small teeth, one on each side, are shed, and their place filled by two large ones. At this time there are four large teeth in front, flanked by two pointed ones. The fourth year the large teeth are six in number, and but two small teeth remain — one at each side. These disappear during the fifth year, when all the front teeth are large. Signs of wear are visible early in the sixth year; and during the seventh year (sometimes even earlier) they begin to fall out, or are broken off.

Wool, and its Characteristics.—Fineness of pile first attracts attention, and is of greater importance than any other property, with the exception of quantity. The wool covering the ribs, back, shoulders, and side of the neck, is considered the finest; and next in order is that clothing the upper parts of the legs and thighs, and extending up to within a short distance of the haunch and tail. A coarser kind of wool covers the upper part of the neck, the throat, breast, belly, and lower parts of the legs. Temperature, pasture, food, and general management exert a great influence on the fineness and quality of wool; and the value of the sheep is in proportion to the equal quality of the wool on all parts of its body. Soundness and elasticity are likewise very important properties, more especially in long wool, in which they are indispensable requisites. Fine wool has a perfectly regular fibre, and is free from coarse hairs; and fineness of staple is always accompanied by an equal growth of wool over all parts of the animal, and marked by an absence of those shaggy spots observable on poor and half-fed sheep. Felting on the back of the sheep very much injures the quality of wool; and, though this is a frequent occurrence among heavy breeds, yet it is more commonly the result of neglect and a scanty supply of food. Another desirable quality is softness of pile, which, in the opinion of manufacturers, cannot be too soft and silky, provided the strength remains unimpaired. This quality measurably depends on the fineness of the fibre; and as the yolk imparts richness and pliability, as well as nourishment, to the wool, it necessarily



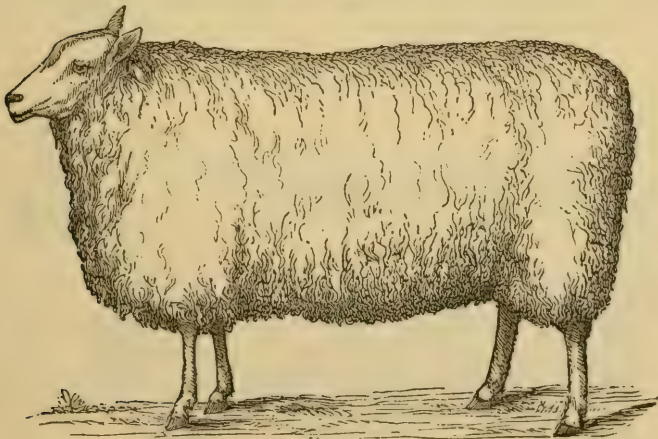
exerts some influence on the softness of the pile. The color of wool, though of minor is yet of no trifling importance; for the purchaser never loses sight of the qualities of purity and perfect whiteness.

VARIETIES.

TARTAR.—This is a valuable breed, for sometime introduced into the United States. They are a medium-sized animal, with agreeably-expressive faces, prominent noses, ears drooping forward, and covered with short, but very fine, glossy, silken hair. The principal value of this animal consists in its remarkable powers of procreation—the ewes producing lambs twice each year, and from three to four, and not unfrequently five at a time. The quality of the mutton being of the highest order, devoid of woolly or other disagreeable taste, and possessing a delicacy resembling venison, with their capacity for furnishing lambs at all seasons of the year, make them of great value to those whose chief object is to breed for the butcher.

LONG-WOOLED.—The long-wooled sheep are of the largest size. The

Fig. 208.

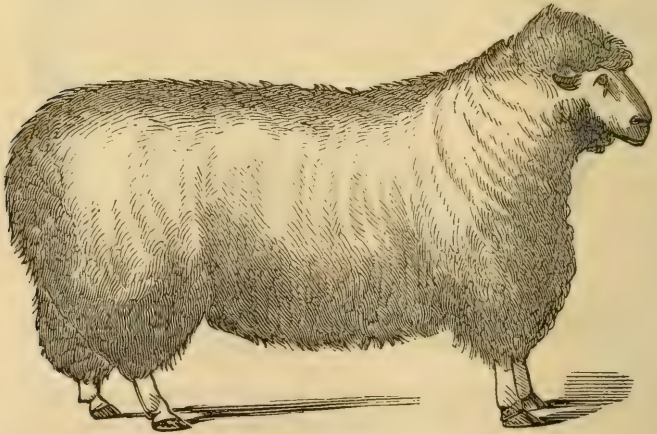


New Leicester or Dishley breed stands deservedly at the head of the list and, indeed, for symmetry of shape, early maturity, and attaining to a con

siderable size, it stands unrivaled. The preceding figure is a very fair specimen.

This breed owes its origin to the late Mr. Bakewell, a celebrated breeder, of Dishley, in Leicestershire, England. It is inferior, in size and quality of wool, to many of the larger varieties, but for early maturity and aptitude to fatten it has not been surpassed. It should have a tapering head, long, and hornless; eyes prominent, and a quiet expression; ears thin, long, directed backwards; neck full and broad at its base, gradually tapering towards the head, particularly bare at the junction with the head; the neck seeming to project straight from the chest, so that there is, with the slightest possible deviation, one continued horizontal line from the rump to the pole; breast broad and full; shoulders broad and round,—no uneven or angular formation, no rising of the withers, no hollow behind the situation of these bones; arm fleshy throughout, even down to the knee; bones of the leg small, standing wide apart,—no looseness of skin about them, and rather bare of wool; chest and barrel deep and round; ribs forming a considerable arch from the spine; the barrel ribbed well home; carcass gradually diminishing in width towards the rump; quarters long and full; legs medium length; pelt moderately thin, soft, elastic, covered with a good quantity of fine, white wool. The principal races of this breed are the New Leicester, the Lincolnshire, Teeswater, Devonshire Notts, Romney Marsh, and the Cotswold. Fig. 209 is a portrait of one of the latter.

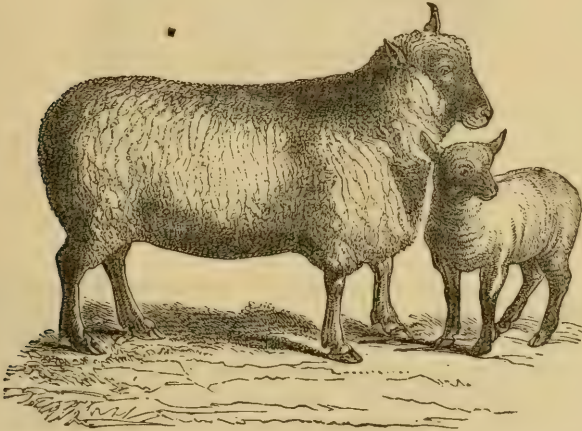
Fig. 209.



SHORT-WOOLED. — The short-wooled varieties of sheep are very numerous,

and are also distinguished generally by smallness of size. They are hardier than the larger sheep, yet, with few exceptions, not so well calculated for the exposed and mountainous sections. The Cheviot and South-Down are very generally diffused varieties of this class, both kinds being hornless. Fig. 210 is a South-Down ewe and lamb, of the most improved sort.

Fig. 210.



The points in this valuable breed are principally as follows : — The head should be neither too long nor too short ; the lip thin ; the neck moderately long, thin next to the head, and tapering towards the shoulders ; breast wide and deep, projecting forward before the fore-legs, which indicates a good constitution and disposition to feed ; the shoulders not too wide between the plate-bones, but on a level with the chine ; chine low and straight from the shoulders to the tail ; the ribs should project horizontally from the chine, as the animal will then lay its meat on the prime parts ; the sides high and parallel ; rump long and broad ; the tail set on high, and nearly on a level with the chine ; hips wide ; ribs circular, and barrel-shaped ; legs neither very long nor very short ; the bones moderately fine.

BLACK-FACED.—The Black-faced or Heath sheep are distinguished by black faces and legs, and large and spirally-twisted horns. The female is however, frequently hornless. The fleece is long, coarse, and shaggy, extending over the forehead and lower jaw. This is an active and hardy race, capable of subsisting in the most exposed situations, producing mutton of excellent quality, though not generally fattened till four or five years old.

Their wool is not so valuable as that of the Cheviots. Fig. 211 represents one of the black-faced race.

Fig. 211.



MERINO.— This celebrated and most useful breed are distinguished by the fineness and felting quality of their wool, and the weight yielded by each sheep, — the ease with which they adapt themselves to the climate, the readiness with which they take to the coarsest food, their gentleness and tractability. Their defects are their unprofitable and unthrifty form, voracity of appetite, a tendency to barrenness, neglect of their young, and

Fig. 212.



inferior flavor of the mutton. The wool, lying closer and thicker over the body than in most other breeds of sheep, and being abundant in yolk, is covered with a dirty crust, often full of cracks. The legs are long, yet

small in the bone; the breast and back narrow, and the sides somewhat flat; the fore-shoulders and bosoms are heavy, and too much of their weight is carried on the coarser parts. The horns of the male are comparatively large, curved, more or less spiral; head large, but forehead rather low. A few of the females are horned, but, generally speaking, are destitute. Both male and female have a peculiar coarse and unsightly growth of hair on the forehead and cheeks; the other part of the face has a pleasing and characteristic velvet appearance. Under the throat there is a singular looseness of skin, which gives them a remarkable appearance of throatiness, or hollowness in the pile; the pile, when pressed upon, is hard and unyielding, on account of the thickness with which it grows upon the pelt, and the abundance of the yolk detaining all the dirt and gravel which fall upon it, though, when examined, the fibre exceeds in fineness, and in the number of serrations and curves, that which any other sheep in the world produces. Fig. 212 is a representation of the Merino breed.

III. SWINE.

Breeding and Rearing. — These animals arrive early at maturity. The sow is fit to receive the male when little more than eight months old, and the latter is capable of propagating at the same early period; but neither of them should be allowed to be used for the purposes of breeding until they have completed their first year, and the male should be admitted only to a limited number of females for some time after. The period of gestation in the sow is about sixteen weeks; and the number of young produced at a birth varies from five to ten or twelve, sometimes even to eighteen or twenty, and two litters are produced in the year, or even five in two years.

She is ready to receive the male soon after the birth of her young, but the period of impregnation should be regulated by that at which it is desirable the young should be produced. The winter is a bad season. The periods of impregnation should be about the beginning of October and April, as the young will then be produced in February and August, so that the last litter will have gained full strength before the approach of winter.

The pregnant sow should be separated from the herd, but should not be entirely confined. The period of bringing forth will be generally known by the animal carrying straw in her mouth to make her bed some time previous; and she must then be well littered with short straw, for, when profusely littered with long straw, the young pigs are liable to be injured or killed by the mothers, while they are nestling unperceived under the straw.

Treatment of Dam and Young. — The young animals, being extremely tender, are liable to be destroyed immediately after their birth by the mo-

tion of the dam ; and, to guard against this, they should be watched, and the young ones removed from her as they are brought forth. During the first and second day after the birth of the young, or until they acquire strength, they should be removed from the dam, and only occasionally admitted to suck. While nursing, she should be well fed, and the pigs accustomed to feed from a trough on milk, whey, or any liquid food, mixed with a little meal or bran.

Castrating. — The males may be castrated when about a month old ; and a like operation, though not absolutely necessary, may be performed, at the same age, on such of the females as are not intended for breeding.

Weaning. — The period of weaning is regulated by the manner in which the young pigs have been fed ; and, when they have been liberally supplied with food, it need not be deferred longer than six or seven weeks ; for, when delayed beyond this, the sow will be in low condition as the time of bringing forth her young again approaches.

Treatment after Weaning. — When weaned, the young pigs should be fed three times a day on nutritious and chiefly farinaceous food, combined with milk or whey ; and, in a few weeks, they will consume the ordinary roots cultivated upon the farm. In some instances, the young pigs are disposed of while they are sucking, especially when the number brought forth is greater than the dam can perfectly support ; and, when intended for being killed, they are then termed porkers, or roasters.

The young pigs, after being weaned, are sometimes allowed to go at large through the pastures, and have to depend on these chiefly for their food. In this case, they frequently do great injury to the fields. The best plan is to confine them in pens, allowing them occasionally to go through the feeding-yard, to pick up any refuse food scattered through it ; and, in addition to this, supply them with a little green food, as clover during summer, and turnips or potatoes during winter.

Food. — The food of swine may be of a more varied character than that of any other animal. Every kind of animal refuse, as that of the dairy and kitchen, is eagerly consumed by them ; — roots, raw or boiled ; different kinds of seeds ; brewers' grains, and the wash of the distillery. It is important that they should be liberally and regularly supplied with food. They ought to be fed three times in the day ; and the troughs should be emptied before a fresh supply is given, and washed out occasionally, so as to keep them clean. The hog delights to wallow in the mire, but prefers a clean bed at night. The food should be varied — liquid and solid.

Disposition of the Carcass. — The flesh of the hog may be disposed of in two ways. The one is to yield pork, and the other to produce bacon. In

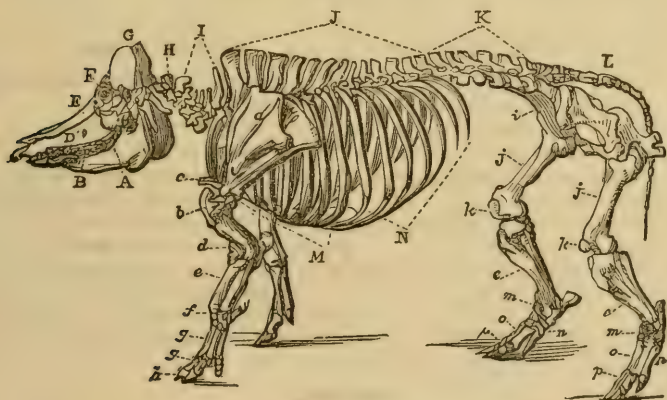
the former case, the age seldom exceeds six or eight months and in the latter, ten or twelve.

When the substances employed in fattening have been juicy rather than nutritious, the flesh will be much improved by feeding with bran-meal, mixed with the other food, for some time previous to killing the animals. This is more essential in producing bacon, as it tends to harden the flesh, and render it of that mellow firmness which constitutes the essential property of fine hams and bacon. Some time previous to the period of killing the animal, therefore, the food may consist of about two thirds of steamed potatoes, or other roots, and one third of ground pease, barley, oats, or bran, enlarging the quantity of farinaceous food as the animal fattens.

An important matter in the management of swine is the preservation of the flesh after the animals are killed. In the case of pickling pork, the carcass is cut in pieces, and packed. A solution of salt in water is prepared, strong enough to swim an egg, which is to be boiled, and, as soon as it has cooled again, it is poured on the pork, so as to cover it. The vessel is now closed up, and the pork ready for market.

In the making of bacon, the hams or legs are separated from the flitches or sides, as close to the latter as possible without injuring their appearance. The body is then separated from the head, and cut longitudinally in the direction of the back-bone, and then transversely between the second and third ribs. The hams and flitches are then laid on boards, sprinkled with

Fig. 213.



saltpetre, and covered with salt, — better if rubbed in by the hands. Put them in a cool place, and in this state let them remain about a week, after which

they should be turned, and an additional quantity of salt sprinkled over them. In about two or three weeks from the period of the first salting, they may be hung up in the chimney of the kitchen, or in a smoke-house, to dry. In Westphalia, and some other places noted for the flavor of the hams produced, sugar is commonly used in curing, in the proportion of about one pound of sugar to three of salt, and two ounces of saltpetre. The sugar assists in preserving the meat, rendering its fibre mellow, and corrects the extreme pungency which is often occasioned by the too free use of salt. In every case, after the hams and flitches have remained hanging a sufficient time to dry them, they are taken down, and packed up in seeds from the mill, or sawdust, in which they remain until required for use. The proper period for curing bacon is during the cold weather.

In order that those who are unacquainted with the anatomy of the pig may possess the means of informing themselves in regard to that subject, we give the preceding skeleton, explained as follows:—

The Head.

- A. Maxilla inferior, vel posterior — lower jaw.
- B. Dentes — the teeth.
- C. Ossa nasi — the nasal bones.
- D. Maxilla superior, vel anterior — upper jaw.
- E. Os frontis — the frontal bone.
- F. Orbiculus — the orbit or socket of the eye.
- G. Os occipitis — the occipital bone.

The Trunk.

- H. Atlas — the first vertebra of the neck.
- I. Vertebrae colli, vel cervicales — the vertebrae of the neck.
- J. Vertebrae dorsi, vel dorsales — the vertebrae of the back.
- K. Vertebrae lumborum, vel lumbales — the vertebrae of the loins.
- L. Ossa coccygis — the bones of the tail.

Fore Extremity.

- a. Scapula — the shoulder-blade.

- b. Humerus — the round shoulder bone.
- c. Sternum — the breast bone.
- d. Ulna — the elbow.
- e. Radius — the bone of the fore-arm.
- f. Os naviculare — the navicular bone.
- g. g. Phalanges, vel ossa pedis — the first and second bones of the foot.
- h. Phalanges, vel ossa pedis — the bones of the hoof.

Hind Extremities.

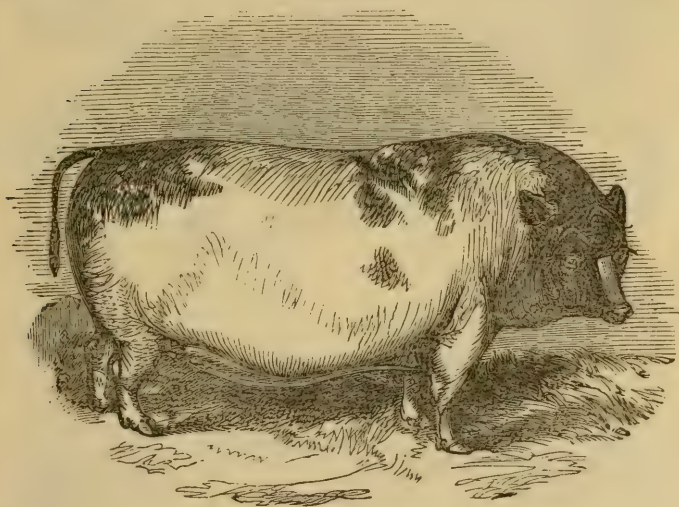
- i. i. Pelvis (ossa innominata) — the haunch bones.
- j. j. Os femoris — the thigh bone.
- k. k. Patella — the stifle bone.
- l. l. Tibia — the upper bone of the leg.
- m. m. Tarsus (one of which is the (N) os calcis) — the hock bones.
- n. n. Os naviculare — the navicular bone.
- o. o. Digiti, vel phalanges (ossa pedis) — the first digits of the foot.
- p. p. Digiti, vel phalanges (ossa pedis) — the second digits of the foot.

VARIETIES.

CHINA. — The Chinese breed was originally obtained from Asia. There are two distinct species, the white and the black; the former better shaped

than the latter, but less hardy and prolific. Both are small-limbed, ears and head fine, round in the carcass, thin-skinned, and the head so imbedded in the neck, that when quite fat, the end only of the snout can be seen. They seldom reach a very great weight; they are rather difficult to rear, and the sows are bad nurses. Their flesh is somewhat tender for bacon, has rather too large a proportion of fat, and their hind-quarters are so deficient in proportion to the size of the other parts, that they cut up to considerable disadvantage for hams. But their great aptitude to fatten, and the extreme delicacy of their meat, — which, when young, is unrivaled, — render them very valuable.

Fig. 214.



The black race are thrifty, and fatten on a comparatively small quantity of food; which valuable properties are so desirable that, notwithstanding their small size, they are crossed with other breeds to a very considerable advantage, producing several kinds possessing properties superior to those of the parent stock. They are also very prolific.

There is also a mixed breed, patched with black and white, — some with thick, pointed ears, like the true species, which they otherwise resemble in form, while in others the ears are rounded, and hang down.

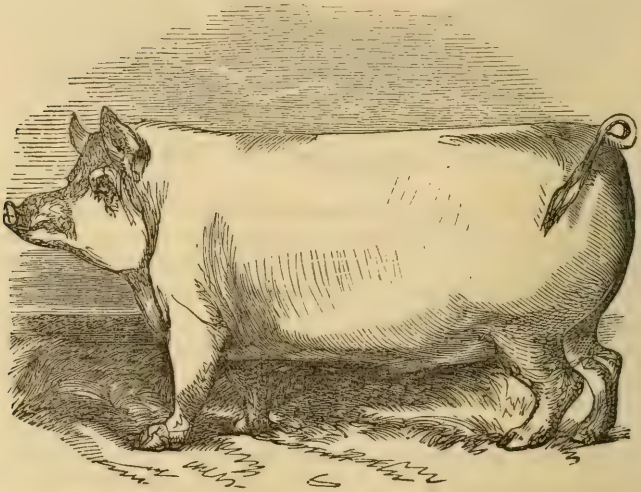
BERKSHIRE. — The Berkshire hog is of a reddish-brown color, with black spots; the head well placed, with large ears, generally standing forward, though sometimes hanging over. He is short-legged, small-boned, and of a

rough, curly coat. Their bacon is very superior, and the animals attain to a great size.

Fig. 215.



Fig. 216.



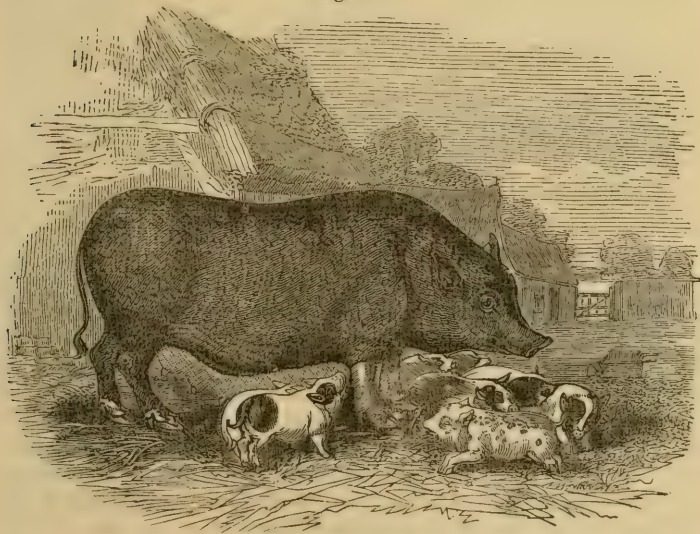
The crosses of this breed are so numerous, that any attempt to distinguish them, and particularize as to their merits, would be futile. Fig. 215.

SUFFOLK. — The Suffolk breed has been long in repute as a hardy and prolific species, though generally of only moderate or rather small size ; and when crossed with either the Berkshire or Dishley breed, produces animals which are in very general esteem. They fatten quickly, but their shape is not considered altogether valuable for making bacon. Fig. 216 is an example of an animal of this breed.

WOBURN. — The Woburn breed is white, mixed with various colors, well-formed, round in the carcass, small limbed and headed, hardy, and very prolific, and so kindly disposed to fatten, that they are said to have attained to nearly twice the weight of some other hogs, within the same given period of time.

SIAMESE. — The widely-diffused breed known by this term, on account of its origin, is worthy of notice in this place. The animals are small, and have a cylindrical body, with the back somewhat hollow, and the belly trailing near the ground, on account of the shortness of the limbs. The

Fig. 217.



bristles are soft, the color is usually black, and the skin externally of a rich copper-color. The ears are short, small, and somewhat erect. The animals are not over-hardy or prolific, and the females do not yie'd the same

quantity of milk ; but they arrive very soon at maturity, they fatten on a small quantity of food, and their flesh is white and delicate.

IV. THE HORSE.

Rearing and Breeding.—In the breeding of the horse, it is important that the parent, of either sex, be free from disease ; for the diseases, as well as the good properties, of the animal, are transmitted to their offspring. In breeding, attention should be paid to the female as well as to the male parent, else disappointment may result with respect to the form and properties of the progeny.

A mare is capable of receiving the male at an early age ; but it is an error to commence breeding from any mare before strength has been acquired, and her form developed, — which will rarely be sooner than at three or four years of age. The mare comes into season in spring, and goes with young about eleven months, although with an irregularity, even to the extent of several weeks on either side of that period. The most convenient time for her receiving the male is in May, that she may foal in April, when the herbage begins to spring. From the time she receives the male till that of foaling, the farm mare may be kept at her usual work. She will give notice of the period of foaling, by the extension of the udder, and other symptoms, and she may then be released from work. In general, little difficulty or danger attends the parturition of the mare. She rarely requires assistance ; but, should difficulty really arise, from the particular position of the fœtus, it is well to obtain the assistance of a practised hand, lest the mare be injured by unskilful and violent means. As soon as the mare has foaled, she should be placed with her young, either in a house, or, what is better, in a pasture-close, with a shed to which she may go at all times. It is necessary, at this period, to supply her with nourishing food. It is better that the mother be kept in a field, and permitted to suckle the young undisturbed. But yet she may be put, without danger or injury, to moderate work, within a short time after foaling. For a time, the foal should be shut up in a house during the hours of work, which then should not be too long ; but, after the colt has acquired a little strength, it may be permitted to follow the mother even when at work in the field. Many, indeed, do not approve of this practice, on account of the chance of accidents to the foal. But accidents seldom occur, and the foal has an opportunity of taking milk more frequently, is the better for exercise, and becomes useful to the objects around it. In nine days or more after foaling, the mare will be again in season, and may receive the male.

Weaning.—In six months, the foal is to be weaned, which is done merely by separating it from the dam. It is then best put in a field. The mother

is then put to her ordinary work, and treated as usual. At the time of weaning, and during all the period of its growth, the foal should be liberally fed. Bruised oats, meal, or any farinaceous food, may be given to it. It is not necessary or proper that it be pampered, but it is important to its growth and vigor that it be supplied with sufficient food.

Castrating. — The male foal intended for agricultural purposes must be castrated, and the best time for the operation is at one year old. Some do it before weaning, but it is better that it be delayed till the masculine form of the animal has been more developed. The details of this operation must be left to the experienced practitioner. Little improvement has been effected on the old mode, except the opening of the scrotum, and the division of the cord by the knife, instead of the heated iron.

Training and Management of Colts. — If the colt be intended for the saddle, it is well that from this period it be accustomed to gentle handling by the person who feeds it, to render it docile and good-tempered. Anything like harshness is to be carefully avoided. The colts are kept in their pastures during the summer, and when these fail before winter, the animals may be put into a yard with sheds, and plentifully littered with straw. They may receive straw for half the winter, and hay towards spring, when the straw becomes dry and unpalatable; and turnips, or any green food, should be supplied freely in the winter. They should have a piece of ground on which they may run in winter, on account of their health and the state of their feet. As early in spring as the pastures will allow, they are to be turned out to graze in the fields, where they are to be kept during summer, and in the following winter treated in the same manner as before. They are also to be treated in a similar manner in the following summer and winter, after which, that is, when three years old, they will be in a condition to be broken in; and, if draught-horses, employed in the work of the farm, they may be taken up for training even in the third autumn of their age, though at this period the work should be very gentle.

A farm-horse usually receives little training; but the colt should have a bridle with an easy bit put upon him for a few days, and allowed to champ it for an hour or two at a time, in a stall. The harness being then put upon him by degrees, he may be trained to the different labors required of him. In general, the farm-horse, working with his fellows, is easily made obedient. But when a farm-horse is four or five years old before he is put to work, or if he is a stallion, or if he shows any vice, he should have more training. And if a valuable horse, and fit also for the saddle and the carriage, the more training the better. In every case, gentleness and kind treatment are to be strictly observed in the management of the colt. He is first to be taught his duties, and corrected afterwards only

when necessary to secure submission, fear being the feeling which controls the animal. The farm-horse demands, neither in the training nor in the feeding, that nicety which is required in the case of the horse designed for rapid motion or irregular labor. He must be kept in good order, never to be worked beyond his power, and never be allowed to fall, in condition, below the work which he is to perform.

Food.—The food of the horse consists of herbage, or green forage ; of dried forage, as hay and straw ; of various farinaceous substances, as oats,

EXPLANATION OF SKELETON OF A HORSE.

A A, Cervical Vertebrae,	N N, Large Metacarpal or Cannon.	2, Astragalus,
B B, Dorsal Vertebrae,	O, Small Metacarpal or	3, Cuneiform Magnum,
C, Lumbar Vertebrae,	“ Splint Bones,”	4, “ Medium,
D, Sacrum,	P P, Sesamoid Bones,	5, “ Parvum,
E E, Consygeal Bones,	Q Q, Phalanges, [Bone,	6, Cuboid,
F F, Ribs,	1, Os Suffraginis or Pastern	3, 6, Cubo Cuneiform,
G, Costal Cartilages,	2, Os Coronæ,	X, Large Metatarsal,
H, Scapula,	3, Os Pedis,	1, 2, 3, Phalanges,
I, Humerus,	1, 2, 3, Phalanges,	Y, Small Metatarsal,
K K, Radius,	R, Pelvis,	Z, Head,
L, Ulna,	1, Ileum,	1, Inferior Maxila,
M, Carpus or Knee,	2, Puvis,	2, Superior do,
1, Scaphoid,	3, Ischiam,	3, Anterior do,
2, Senilunar,	S, Femur,	4, Nasal Bone,
3, Cuneiform,	T, Patella,	5, Malar, 6, Frontal,
4, Trapezium,	U, Tibia,	7, Parietal,
5, Trapezoid,	V, Fibula,	8, Occipital,
6, Os Magnum,	W, Hock,	9, Lachrymal,
7, Uneiform,	1, Os Calcis,	10, Squamous } Temporal.
8, Pisiform,		11, Petrous }

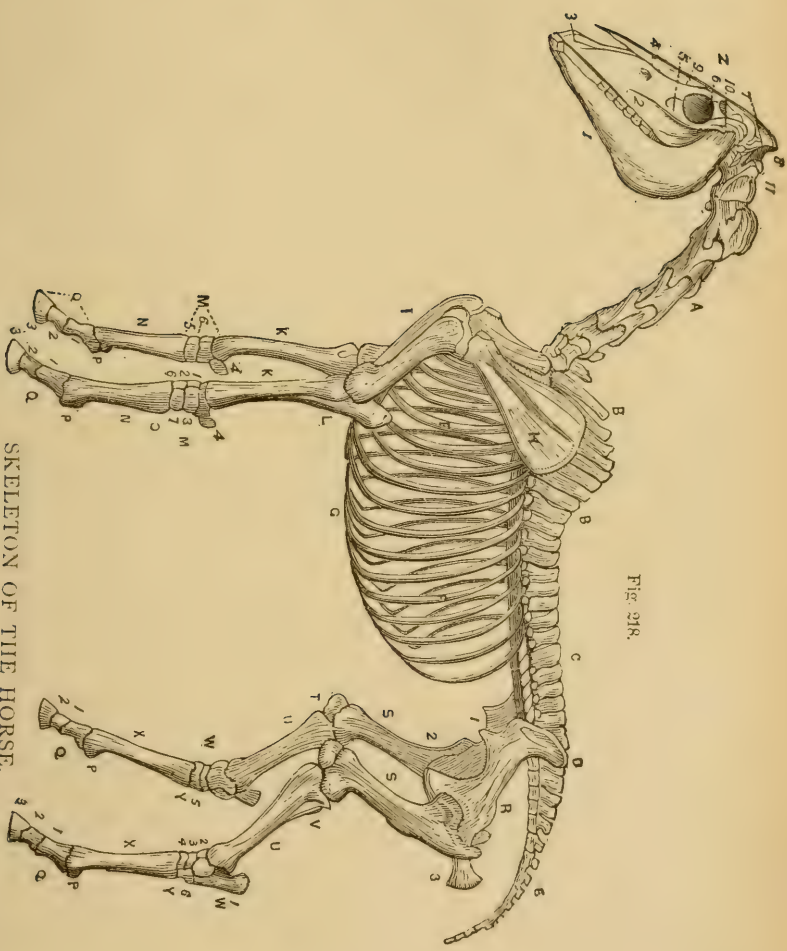


Fig. 218.

SKELETON OF THE HORSE.

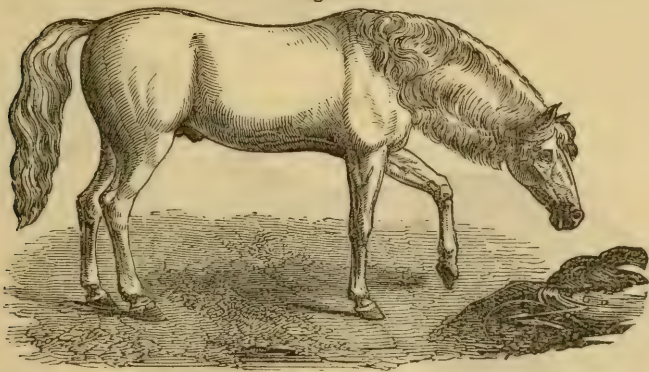
peas, and beans ; and of the juicy roots, as the potato, the turnip, the carrot, the parsnip, and the beet. Of the grains given to the horse, the most general, and best adapted to his strength and spirit, is the oat. It is, for the most part, given to the horse without any preparation, though it is better masticated and digested when bruised. Two gallons per day, or nine pounds, are considered to be good feeding, when the horse is on dry food, and not on hard work ; when on hard work, the quantity may be increased to three gallons, and when on light work and green food, it may be reduced to one gallon, and sometimes altogether withdrawn. But, on an average, ninety bushels in the year will be sufficient, in every case, for the working horse of a farm. Meal is a refreshing feed to a horse on a journey, and a safe one when the chill is just taken off the water. Beans, when bruised, are excellent food, tending to correct laxativeness.

Fig. 218 is explanatory of the name and situation of the external parts of a horse.

VARIETIES.

ARABIAN. — The celebrated Arabian breed of horses, of which the figure presented below is a fine portrait, are more compact than the horses of Barbary, having a rounder body, shorter limbs, with more of sinew, or

Fig. 219.



what is termed bone. Yet they are of the smaller class of horses, very little exceeding, on a medium, fourteen hands, or fifty-six inches, in height. As compared with the horses of countries abounding in grasses, their aspect is lean, their form slender, their chest narrow. The power of their delicate limbs is indicated by the well-marked muscles of the fore-arm, and the starting sinews of the leg. The shoulder is oblique ; the withers

Fig. 220.

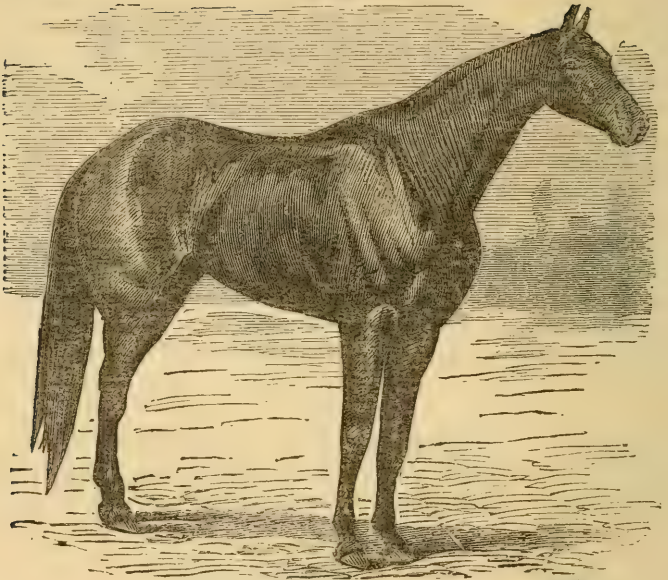


Fig. 221.

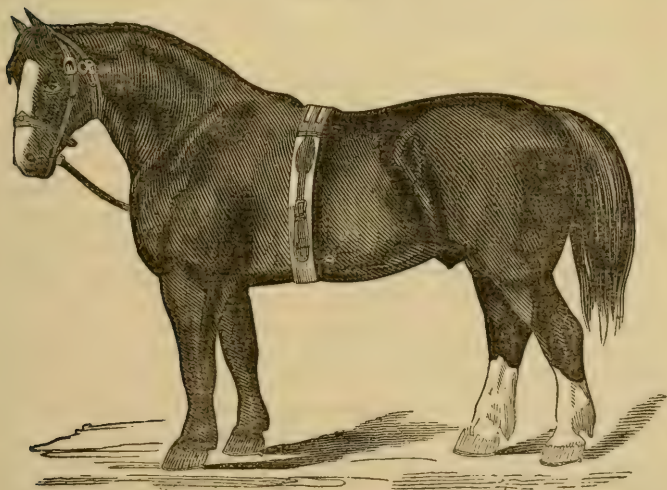


are elevated; the back is moderately short; the quarters are good; the head is well formed; the forehead broad; ears somewhat long, but alert; eyes full and clear; veins prominent. They are remarkably gentle and docile, patient, playful, obedient, and intelligent. They subsist on very scanty fare.

AMERICAN. — The Mexican horses are derived from Spain, and seem in no other respect inferior to the European than a less careful management may account for. The horses of Canada, chiefly of French lineage, are coarse and small, but hardy, muscular, and useful. Those of our own country are of every variety, derived originally from England, but crossed by the modern racer, and by the horses of Syria and Arabia. On this account, we have a very mixed race of horses, many of which are excellent. Such has been the attention paid to the race breed in our country, that the best and fastest trotting horses (see Fig. 220) in the world are now to be found in the United States. Among the American roadsters, the Morgan family stand number one. They are exceedingly compact, deep-chested, strong-backed, fore-legs set wide apart; head small, high and graceful, eyes fine, and well set. The family comprises several varieties, among which the Goss and the Gifford rank very high. We give an engraving (Fig. 221) of one of these animals, which is a fair sample of the average quality.

EUROPEAN. — Of the European breeds, the present Norman horse is the

Fig. 222.



most enduring and hard-pulling. The Clydesdale is a valuable breed of cart horses, bred chiefly in the valley of the Clyde; they are strong and hardy, have a small head, are longer necked than the Suffolk, with deeper legs, and lighter carcasses. The Suffolk Punch are valuable on farms composed of soils of a moderate degree of tenacity. The preceding figure is that of an improved Norman draught stallion.

V. THE ASS.

Rearing and Breeding.—In breeding from the ass, the same general rules apply as in the case of the horse. The male will procreate at the age of two and a half years, and the female still earlier. The stallion ass should be the largest and strongest, at least three, but not more than ten, years old; his legs should be long, his body plump, head long and light, eyes brisk, nostrils and chest large, neck long, loins fleshy, ribs broad, rump flat, tail short, hair shining, soft, deep gray.

The best time of covering is the last of May, nor must the female be hard worked whilst with foal, for fear of casting; but the more the male is worked, in moderation, the better he will thrive. She brings forth her foal in about a twelve-month, but, to preserve a good breed, she should not produce more than one in two years. The best age to breed at is from three years old to ten. When the foal is cast, it is proper to let it run a year with the dam, and then wean it, by tying up and giving it grass, and sometimes milk; and, when it has forgotten the teat, it should be turned out into a pasture, but if it be in winter, it must be fed at times, till it is able to shift for itself.

Training.—The ass may be broken and trained at the end of the second year, but should not be worked sooner than the third year. Breaking is easily effected when two or three years old, by laying small weights upon his back, and increasing them by degrees.

Age, &c.—The age of the ass is known by his teeth, in the same manner as the horse; viz., at two years and a half old, the first middle incisive teeth fall out, and the others on each side soon follow; they are renewed at the same time, and in the same order. The anatomy and physiology of the ass do not differ very materially from those of the horse.

Characteristics.—The ass is naturally humble, patient, and quiet. He is extremely hardy, both as to the quantity and quality of his food, contenting himself with the most harsh and disagreeable herbs. In the choice of water, he is very nice, drinking only of that which is perfectly clear. He requires very little looking after, and sustains labor beyond most others. He is seldom or never sick, and endures hunger and thirst most resolutely. The milk of the ass is the lightest of all milks, and is excellent for persons of delicate stomachs.

VI. THE MULE.

Rearing, Breeding, &c. — In the breeding of mules, mares of a large breed and well made should be employed. They should be young, lively, large-barrelled, small-limbed, moderate-sized head, and a good forehead. It is well to have the foals, from the time of their being dropped, often handled, to make them gentle; it prevents their hurting themselves by skittishness and sudden frights, and they are much easier broken at the proper age, and become docile and harmless. They may be broken at three years old, but not hard worked till four. Give them food enough to prevent their losing flesh and to keep up their growth, without palling their appetites with delicacies, or making them over fat. They should also have sufficient stable room, and good litter to sleep on, besides being well rubbed down every day, particularly in cold, raw, wet weather. When three years old, mules are proper for use.

Mules are now brought to an astonishing degree of perfection. They are usually strong, well-limbed, large, sure-footed, and capable of carrying great burdens, and travelling great distances. Some think it surprising that these animals are not more propagated, as they are so much hardier and stronger than horses, less subject to diseases, and capable of living and working to almost twice the age of a horse. Those that are bred in cold countries are more hardy and fit for labor than those bred in hot. The general complaint against them is that they kick and are stubborn, but this is owing to neglect in breeding.

VII. THE GOAT.

Description, &c. — The goat appears to be the connecting link between the sheep and antelope tribes. It is lively, and though the natural inhabitant of a mountainous region, is easily domesticated. But it is in wild, rocky countries, that the goat is chiefly reared. The female gives a great quantity of milk for so small a creature, and its quality is very superior. She is readily taught to suckle the young of other animals, and feeds in situations where the cow could not subsist, which latter is a valuable quality. It arrives early at maturity, and is very prolific, bearing two and sometimes three kids at a birth. It does not produce wool, but its hair may be shorn, and is of some value; and its skin, especially that of the kid, is very valuable. The flesh of the kid, though not much sought after, is equal to that of the finest lamb.

The male will engender when one year old, and the female at eight months; but good stock must come by parents not so young. From two to five years the male is most vigorous, and the female bears her best kids from two to eight years. Goats bear well the motion and confinement of ship-board, and give the best of milk.

VARIETIES.

There are three principal species enumerated, viz., the wild goat, the ibex, and the Caucasian ibex; from the first-named the different varieties of the common domestic goat are believed to have originated. Perhaps the most celebrated and valuable of all the various breeds is the Thibet

Fig. 223.



(Fig. 223), on account of the soft and delicate wool they produce, and which falls off in the warmer seasons. These goats are long-bodied, large hooked horns, stout limbs, and very long glossy hair. The color is frequently milk-white, but more generally brown, with points of a golden hue.

VIII. THE DOG.

Rearing, Breeding, &c. — In breeding, for first-rate animals, ascertain the pedigree for at least four generations. The male should be not less than two years old, and the female at least fifteen months. The male need not be rejected as unfit until his eighth year, if healthy and vigorous, nor the female, under similar circumstances, till her sixth year. The female goes

with young sixty-three days, and has from four to thirteen young at a birth. The dam may be allowed to breed only three times in two years, and to rear not more than five puppies; the whelps should not be suckled longer than six weeks, and five, or even four, is long enough, if necessary to remove them. After weaning, feed them moderately with porridge, mashed potatoes, with skim milk, or new milk, to dilute the mess; let it be fresh and cool. They should also have a bed of clean straw, fresh water, and an open, airy place for exercise and sport.

At about four months old, the first set of teeth begin to drop out, and are replaced by the permanent set. About the twelfth month, the tusks have acquired their full length. At two years old, a yellow circle appears around the base of the tusks, gradually developing itself more and more, till the third year, when the edges of the front or cutting teeth begin to be worn down, and the little *nick*, or the crown of the lateral incisors, to disappear. As the fourth year approaches, the tusks lose their points, and the teeth begin to decay. As soon as his eighth year has passed away, a few gray hairs show themselves around his eyes, and at the corners of the mouth. At the age of twelve to fourteen years, confirmed infirmity sets in, and the animal does not survive long after.

The dewclaws—the fifth toe upon the hind foot—should be removed, if removed at all, with a pair of large, sharp scissors; let the pup be held by one person, while another feels for the proper place to cut, which must be done with decision. Cropping, which is, equally with the previous operation, a very cruel one, must be done, if done at all, by drawing the ears over the head until the points meet; then, with a very sharp pair of scissors, cut both points off to the desired length; and, with a single cut to each, from below upwards, cut away the hinder portion of the flaps of the ears up to the point. In a week the ears will be well. In training dogs, gentleness does more than harshness and violence can effect.

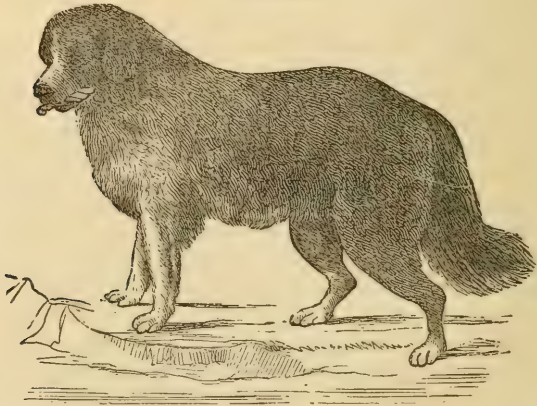
VARIETIES.

NEWFOUNDLAND.—The true breed of Newfoundland is a dog of moderate stature, seldom exceeding twenty-six or twenty-seven inches in height; long-bodied, broad-chested, shaggy coat; pointed, wolfish muzzle; ears small, and inclined to be semi-erect; color usually black, with a shade of brown through it, and occasionally some white. The large dogs of the Newfoundland breed, which have been improved by crossing with the mastiff, are more showy, but less valuable.

The Newfoundland are remarkably docile and obedient, faithful, good-natured, and ever friendly to man. They will defend their master and their master's property, and suffer no person to injure the one or the other; and

however imminent the danger, will not leave them for a minute. They seem only to want the faculty of speech, in order to make their good wishes and feelings understood, and they are capable of being trained for almost all the purposes for which every other variety of the canine species is used. They are a famous water-dog, and have saved many human beings from drowning.

Fig. 224.



SHEPHERD. — The shepherd's dog of Scotland stands about twenty-one inches in height at the shoulder, is very gracefully shaped, muzzle pointed,

Fig. 225.



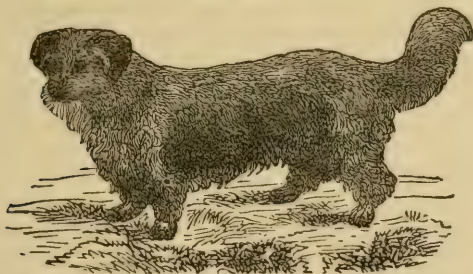
ears half erect, coat long but fine and silky, tail and hams fringed with hair, and the color usually black and tan, or sandy yellow. The animal is remarkable for his sagacity, and his disposition to tend live stock appears to be inherent and hereditary. The English shepherd's dog is larger and stronger than the Scotch, and has much of the appearance of a cross with the great rough water-dog. It is coarser in the muzzle and in coat, and is destitute of tail. It is, however, equally sagacious.

DROVER. — The drover's dog bears considerable resemblance to the sheep-dog, and has usually the same prevailing black or brown color. He possesses all the docility of the sheep-dog, with more courage, and sometimes a degree of ferocity, arising from improper training and uses.

SETTER. — The setter, or land spaniel, comprises several varieties. He is by some sportsmen preferred to the pointer; and where water is to be got at occasionally, during a day's shooting, he is undoubtedly superior. In disposition the setter is more affectionate than the pointer, but requires more training, and that of a mild and gentle character.

TERRIER. — The terrier is a dog of very great utility, and of very varied form and size. They all have one common characteristic, which makes them

Fig. 226.



extremely useful, which is, a determined hostility to those animals termed vermin, as foxes, otters, polecats, rats, mice, &c.

DISEASES OF THE FOREGOING ANIMALS.

Abscess. — As soon as the abscess is brought to a head, let the matter be evacuated, either naturally by a bran-poultice, or by opening with a broad-shouldered lancet. Keep the part clean, trim the hair, and inject into the wound a little tincture of myrrh and aloes. If the cavity does not soon fill up, inject, once or twice a day, a wash of a half-ounce of bluestone, with half a pint of water.

Apoplexy. — For *Horses*, bleed two gallons from a vein at once, remove the dung with the hand and give the following mixture: Barbadoes aloes

1 oz., Epsom salts 6 oz., water 2 pts. For apoplexy or staggers in *Cattle*, bleed from four to six quarts, till the beast is faint, and give, every six hours, a mixture of Epsom salts 1½ lbs., linseed oil 1 pt., warm water 3 pts., with only half the quantity of salts and oil, till they are well purged; after which, give, twice a day, tartar emetic 2 scruples, powdered nitre ½ oz., gruel 3 pts.,—mixed for use. For apoplexy in *Sheep*, bleed a quart, and give, for a purging drench, Epsom salts 2 oz., linseed oil 2 oz., warm water 4 oz.; repeated every six hours, if the bowels are not well opened, and give once or twice a day tartar emetic 10 grs., nitre 2 drs., gruel 2 oz.,—mix for use. For apoplexy or staggers in *Pigs*, bleed, and then open the bowels with Epsom salts and sulphur.

(*Alteratives.*)—These are medicines which operate without producing very decided evacuations. For *Sheep*, mix together one ounce of Ethiop's mineral, 2 ounces of nitre, 4 ounces of sulphur;—give about two drachms daily, till the animal is cured. For the *Cow*, the dose is from a half to a whole ounce daily. For the *Horse*, one ounce to an ounce and a half, made into a ball with soft soap. If there is any tendency to grease, add to each ball one drachm of powdered resin. In cases of weakness, two drachms of gentian powdered, and one drachm of ginger powdered. For *Dogs*, flour of sulphur 12 oz., powd. nitre 2 oz., Ethiop's mineral 1 oz., treacle sufficient to make a mass; give a piece the size of a nut to a walnut, according to the size of the dog.

Black Quarter.—Also known as Quarter Evil, Quarter Ill, Black Leg, Blood Striking, The Blood Joint Felon, or Inflammatory Evil.—Symptoms—extension of neck, red eyes, breath hot, muzzle dry, pulse quick, heaving, moaning, loss of appetite, lameness. Bleed copiously, then give a strong purgative dose, composed of 1½ lbs. Epsom salts, 1 pint linseed oil, 3 pints water. The wearing a seton, occasional doses of physic, and frequent careful examinations by the owner, are better than all else to prevent this disease. In *Sheep*, bleed from the jugular vein till the sheep falls, and give Epsom salts 2 oz., linseed oil 2 oz., gruel 4 oz., till the bowels are well relieved; then give, twice a day, tartar emetic 10 grains, camphor 20 gr., nitre 2 dr., gruel a wineglass full.

Black Water.—Also called Red Water, Brown Water, Black Water, Moor Ill, &c.—Symptoms—bloody urine, loss of appetite, languor, apathy, seclusion, constipation. Bleed copiously; then give Epsom salts 1 lb., in 2 qts. water, every six hours, in half-pound doses, till the bowels are relieved. Inflammation of the Kidneys, and Inflammation of the Mucous Membrane of the Bladder or Urethra, resemble this disease. The first-named is rare; the second may be treated by bleeding, with a dose of Barbadoes aloes, in powder, 6 to 8 dr., powdered gum Arabic 1 oz., in a pint of water.

Red Water in Sheep — bleed freely, and give for a drench, Epsom salts 2 oz., linseed oil 1 oz., warm water 4 oz., — mix for a dose.

Bog Spavin. — For this well-known disease in horses, a blister is the only means of cure.

Bone Spavin. — Disease of the hock joint: remedied by rest, or cessation from hard work, or putting to moderate work on soft ground. The bony deposit, or inflammation, may be removed by repeated blisters. Use a hot iron only as a last resort.

Botts are grubs, which, in the spring, trouble horses. To kill these, some use common salt in the animal's food, or as an injection. But when once the worm has attached itself to the animal's stomach, it is difficult to remove them.

Bowels, Inflammation of. — In case of inflammation of the external and muscular coats of the bowels of *Horses*, bleed freely till fainting is produced, and give the following purge, — Barbadoes aloes 4 dr., powdered gum Arabic 4 dr., hot water $\frac{1}{2}$ pint; dissolve, and add a pint of linseed oil, and repeat the dose in eight hours. The belly should be stimulated with the following liniment, — mustard $\frac{1}{2}$ lb., spirit of sal-ammoniac 2 oz., water enough to make it creamy. A fever-ball may be given twice a day, made of powdered foxglove $\frac{1}{2}$ dr., tartar emetic 1 dr., nitre 3 dr., with linseed meal and treacle or soft soap sufficient. For inflammation of the mucous membrane of the bowels, produced from an over-dose of physic, give for a purge — prepared chalk 1 oz., powdered bark 2 dr., powdered opium 1 dr., powdered ginger 1 dr., gruel 3 pints, — mix. For inflammation of the bowels of *Cattle*, bleed freely, and give for a purge — Epsom salts 1 lb., hot water 1 qt.; dissolve, and add linseed oil 1 pt., to be repeated in six hours, till the bowels are well relieved, with injections of warm gruel. For the same disease in *Dogs*, bleed, put into a warm bath, and give castor-oil 2 oz., syrup of buckthorn 1 oz., — mix for a dose.

Brain, Inflammation of. — Of the staggers in *Horses* there are two kinds, the Sleepy or Stomach, caused by over-feeding, which must be treated by removing the stomach's contents by the stomach-pump, then bleed, and give an opening ball. Mad staggers arise from inflamed brain; bleed from 4 to 6 qts., and repeat this in six or eight hours, and give the following ball, — Barbadoes aloes 8 to 10 dr., tartar emetic 1 dr., calomel 1 dr., and treacle, inject with warm water and linseed oil. For inflammation of the brain (frenzy or lough) in *Cattle*, bleed till the animal faints, and give for a purge — Epsom salts 1 lb., hot water 1 qt.; dissolve, and add linseed oil 1 pint, — mix for a dose, and repeat every 6 hours till the bowels are relieved. For *Sheep*, bleed freely from the jugular vein, and give for drink — Epsom salts 2 oz., hot water 4 oz.; dissolve, and add linseed oil 2 oz., — mix for use.

Brittleness of Hoof. — Mix 3 oz. oil of tar with 6 oz. of common fish-oil, rub this well into the crust and the hoof.

Broken Knees. — Bathe the wounds with warm water, and apply, for a tincture, Ægyptiacum $\frac{1}{2}$ oz., friar's balsam 1 oz., tincture aloes and myrrh 1 oz., — mix for use. The knee of the horse should be bandaged.

Broken Wind. — This is the rupture of some of the air-cells of the lungs, and is prevented, rather than cured, by occasionally feeding the horse with nutritious food, and avoiding great exertion just after he has been fed, so as not to distend the belly and press upon the lungs.

Bronchitis is catarrh, extending to the entrance of the lungs. Symptoms — hard and rapid breathing, and coughing up mucous matter. Bleed according to the violence of the disease, and blister the brisket and sides with blister ointment well rubbed in, and give for a ball — Barbadoes aloes 2 dr., tartar emetic 1 dr., nitre 4 dr., sulphur 2 dr., with treacle; repeat till the bowels are acted on, assisted by warm and frequent injections, and give, twice a day, a ball made of — tartar emetic 1 dr., powdered foxglove $\frac{1}{2}$ dr., camphor 1 dr., nitre 3 dr., with sufficient treacle.

(*Calves, Diseases of.*) — For *Diarrhœa*, give two or three times a day 2 or 3 table-spoonfuls of — prepared chalk 4 oz., powdered canella bark 1 oz., laudanum 1 oz., water 1 pt. For *Costiveness*, dissolve 2 to 4 oz. — according to age — of Epsom salts in 2 qts. of water, and inject into the stomach by means of the stomach-pump, and, in need, repeat in half doses every 4 hours. For *Canker in the Mouth*, give a dose of Epsom salts, and wash with mel-Ægyptiacum 1 oz., friar's balsam 1 oz.

Canker in Horses' Feet. — Pare the hoof, destroy the fungus by means of the butyr of antimony, and apply tincture of friar's balsam 1 oz., and tincture of aloes and myrrh $\frac{1}{2}$ oz., mixed together.

Canker of Ears, in Dogs. — Apply an ointment of burnt alum in fine powder 1 dr., white vitriol in fine powder 1 dr., spermaceti ointment 4 oz.

Capped Hock. — A Horse affection, produced by a bruise. Apply early and repeatedly a blister.

Catarrh (common), or *Hoose* (common cold). — In slight cases, for *Cattle*, *house*, and give a dose of Epsom salts. If severe, bleed, and then give — Epsom salts $\frac{1}{2}$ lb., ginger 2 dr., powdered aniseed 2 oz., gruel 3 pts. For *Influenza*, bleed 3 to 6 qts., and give for a purge — Epsom salts 1 lb., powdered coriander seeds 1 oz.; dissolve in 3 pints warm gruel. In a *Horse*, give immediately additional warmth, some mash, and a ball or two, each dose, made of — camphor 2 dr., tartar emetic 1 dr., powdered nitre 4 dr., and sufficient linseed meal and soft soap to make a ball; if severe, bleed, and, when better, give daily — powdered nitre 2 dr., do. aniseed 1 oz., do. caraway seeds 1 oz., do. gentian $\frac{1}{2}$ oz., do. ginger 2 dr.; — boil ten min-

utes in a quart of ale, and give new milk warm. In *Sheep*, bleed, and give for a purge, Epsom salts 2 oz., powdered aniseed 2 dr.,—mix, and give in a little warm gruel.

Catarrhal Fever.—Symptoms, in *Horses*, shivering, hot mouth, hot skin, heaving of the flanks, cough, nose red, and discharging a watery matter. If attended to early, bleed moderately, and repeat this if the pulse increases and legs get cold. Keep the bowels open by giving a mixture of Barbadoes aloes 2 dr., gum Arabic $\frac{1}{2}$ oz., water 1 pt., for a dose; inject with warm gruel, and repeat the physic in 12 hours, if necessary. If the throat is sore, apply a blister of powdered cantharides 1 oz., resin ointment 4 oz.,—mix for use. Hot mashies are excellent, and a constant supply of gruel; then, for cooling medicine, give camphor 2 dr., nitre 4 dr., tartar emetic 1 dr., soft soap sufficient to make a ball. This disease must not be confounded with inflammation of the lungs.

Choking.—Use a flexible tube gently; if the choking matter can be felt externally, pour a pint of sweet oil down the throat, and rub outside with the hand.

Colic.—Laudanum 1 oz., spirits of sweet nitre 2 oz., do. of turpentine 2 oz., linseed oil 1 pt.,—mix. Apply hot water, by means of flannels, to the belly, and give an injection of Epsom salts $\frac{1}{2}$ lb., linseed oil 4 oz., water 4 qts.,—mix. If these do not operate well, in half an hour, bleed.

Contracted Foot.—Place the animal in wet clay during the day, or turn him into a moist pasture, properly paring away the sole and the toe, and lowering the heels.

Cough.—Give, in a ball, gum ammoniacum 2 dr., powdered squills 1 dr., camphor 1 dr., soap 2 dr., made into a ball with syrup. If very bad, bleed moderately.

Crib-Biting.—Indicates unsoundness, and tends to colic. Put a strap tight around his neck, or let him wear a muzzle of such a sort as will not prevent him from eating, but will disenable him to seize hold of the manger.

Cud, Loss of.—Give, for a drink, when no particular disorder is apparent, Epsom salts $\frac{1}{2}$ lb., powdered gentian $\frac{1}{2}$ oz., do. caraway seeds 1 oz., do. ginger 2 dr.,—mix, and give in warm gruel.

Curb.—A bony excrescence in the inner side of a horse's hind leg. Give, for a cooling lotion, to reduce the inflammation,—afterwards applying a blister,—sal ammoniac 2 oz., powdered nitre 2 oz., vinegar 1 pt., water 1 qt.,—mix for use.

Diarrhæa.—An excessive discharge of fæcal matter. First give an aperient, either one pint of linseed oil, or, in a quart of water, $\frac{1}{2}$ lb. Epsom salts, 2 dr. powdered ginger,—mix for a dose; then give, for an astringent—

prepared chalk 1 oz., powdered catechu 3 dr., do. opium $\frac{1}{2}$ dr., do. ginger 2 dr.,—mix, and give in a quart of warm gruel.

Distemper in Dogs.—Mix tartar emetic 20 gr., calomel 20 gr., opium 5 gr., and give, in a piece of butter, from 2 to 6 gr., according to size.

Distention of the Rumex, or Grain Sick.—First use the probang, then give 1 pt. of linseed oil; also give injections of warm water.

Dropsy.—In the *Horse*,—give a diuretic ball of powdered resin 2 dr., Castile soap 2 dr., sulphur 4 dr., powdered gentian 2 dr., oil of juniper $\frac{1}{2}$ dr., treacle sufficient to make a ball, once or twice a day. When great debility exists, add a tonic made as follows—powdered gentian 2 dr., do. ginger 1 dr., do. resin 2 dr., Castile soap 2 dr., powdered nitre 3 dr., oil juniper $\frac{1}{2}$ dr., treacle sufficient to form a ball,—to be given once or twice a day.

Dysentery, or Scouring Rot.—Dangerous and generally fatal disease. Take a small quantity of blood, and 1 pt. linseed oil, or Epsom salts $\frac{1}{2}$ lb., powdered caraway seeds 2 oz., to be given in 1 qt. of gruel; afterwards, night and morning, an astringent of prepared chalk 1 oz., powdered catechu 4 dr., do. canella bark 2 dr., do. opium 2 scruples, do. gentian 2 dr., do. ginger 1 dr.,—mix, and give in thick gruel.

Epilepsy, or Fits.—Animals subject to fits should not be rode nor driven. If a *Cow*, either reduce her food or hasten her departure to the butcher. If a *Sheep*, the best treatment is to leave the action of the over-excited nervous energy to cease of itself.

Eye, Inflammation of.—In *Horses*, if on account of cold, give in a ball—emetic tartar $1\frac{1}{2}$ dr., nitre 3 dr., linseed meal and soft soap sufficient to form a ball; and frequently foment the eye with hot water. If it does not abate, use for a lotion—Goulard's extract 1 dr., spirit of wine 1 dr., soft water $\frac{1}{2}$ pt.,—mix, and bathe frequently with a small piece of sponge. If it does not arise from cold, bleed, and give a dose of physic first, and then give the balls and use the lotion as above. In *Cattle*, bleed, and then give, for a purge, Epsom salts 1 lb., caraway seeds 1 oz., water 3 pts.,—mix; the eye to be fomented with hot water frequently, and then use for a lotion—Goulard's extract 2 dr., laudanum 2 dr., water 1 pt.,—mix, and bathe with a sponge; when the inflammation has abated, use the following—purified white vitriol 10 gr., soft water $\frac{1}{2}$ pt.,—mix for use.

Eyes, Weak, in Dogs.—Apply, for a wash, white vitriol 8 gr., soft water $\frac{1}{2}$ pt.,—mix together, and apply, with a piece of linen rag, several times a day.

Farcy.—One of the stages of glanders. Symptoms,—buds or knots on the sides of the face, inner part of thigh, or on the neck; great swelling of the legs and muzzle, cracked heels, bad discharges from the nose, &c. Use a lotion made of—blue vitriol 1 oz., white do. 1 oz., water 1 pt.,—mix;

the ulcers to be bathed with this, night and morning, at the same time using balls made of—bluestone 1 dr., powdered gentian 2 dr., liquorice powder 3 dr., treacle sufficient to form a ball, to be given twice a day. After giving the above for two or three weeks without relief, then give corrosive sublimate 10 gr., gentian powder 2 dr., liquorice do. 4 dr., treacle sufficient to form a ball; give every morning, and if it produces purging or sickness, discontinue at once. If green food is not to be had, give carrots.

Feet, Inflammation of.—Symptoms in a horse,—fidgetiness, fever, moaning, lying down. Bleed freely at the toes, and apply soft linseed meal poultices to the whole foot, removing the shoe and gently paring the hoof; give for a dose—camphor 2 dr., nitre 4 dr., emetic tartar 1 dr., soft soap sufficient to make a ball; if severe, bleed afresh, and the third day, if no relief comes, apply a blister.

Fever in the Horse.—Symptoms,—dulness, cold extremities, bad appetite, constipation. Bleed, and give for a ball—Barbadoes aloes 6 to 8 dr., powdered ginger 2 dr., Castile soap 2 dr., treacle sufficient, &c.; give bran mashes and warm water, and perhaps an injection of warm water, $\frac{1}{2}$ lb. Epsom salts, $\frac{1}{2}$ pt. linseed oil. Afterwards give, night and morning, for a ball, tartar emetic 1 dr., camphor 1 dr., powd. nitre 2 dr., linseed meal and treacle enough to form a ball.

Fistulous Withers.—Require to be treated like Poll Evil.

Flooding.—A discharge of blood from the uterus of the cow, after calving. Apply very cold water to the loins. If it continues, raise the cow's hind parts, give 2 dr. opium every hour, keep the patient quiet, take her calf.

Fly in Sheep.—Appear in May. If the head is sore after the maggots are killed, apply a plaster of bees' wax 2 oz., 1 lb. pitch, spread on warm linen. To destroy the maggots, rub together sal-ammoniac 2 oz., corrosive sublimate $\frac{1}{2}$ oz., dissolved in 2 gals. hot water, and apply the same.

Feet, Diseases of.—*Pumiced* feet may be palliated by bar shoes. *Tread*, or *overreach*,—wash out the dirt carefully, and apply a little friar's balsam, and in bad cases a poultice. *Pricked* or *Wounded Foot* may often be cured by paring down the sole to the quick, and applying a little tow and friar's balsam to the place; if matter has formed, apply a poultice. *Thrush*,—make a paste, of powdered blue vitriol 2 oz., do. white vitriol 1 oz., rubbed down with lard 2 lbs., tar 1 lb.; apply some of this, on a little tow, deeply into the cleft, over night, to be removed in the morning. *Foot Rot*, in *Sheep*,—apply a liquid, of powdered verdigris $\frac{1}{2}$ oz., blue vitriol $\frac{1}{2}$ oz., white do. $\frac{1}{2}$ oz., soft water $\frac{1}{2}$ pt., mixed together, and add nitric acid 1 oz., butyr of antimony 1 oz.; pare away the horn, and apply with a feather to the part affected. *Foul Foot*,—after cutting away the fungous flesh, and using

butyr of antimony, apply a tincture of friar's balsam 1 oz., butyr antimony 1 oz., — mix for use; also give a dose of salts.

Garget. — Inflammation of the internal part of the udder. At first, allow the calf to suckle, and rub about her udder; if unsuccessful, bleed a little, and then give, for a drench, Epsom salts 1 lb., aniseed powdered 1 oz., warm water 3 pts.; bathe the udder, thrice a day, with hot water, and after each bathing rub with yellow basilicon 4 oz., camphor 1 oz., rubbed down with a little spirits of wine, strong mercurial ointment 2 oz., soft soap 16 oz., mixed well together.

Glanders. — Symptom, — peculiar thin, light, glutinous discharge from left nostril. Give, for a ball, bluestone 3 oz., dissolved in water, powdered myrrh 3 oz., do. nitre 8 oz., linseed meal and soft soap sufficient to make the mass into 24 balls; give one night and morning, and inject the ulcers night and morning with a weak solution of chloride of lime, by means of a syringe, at the same time giving the horse green food.

Grease. — An inflammation of the horse's heel, stopping the greasy matter from exuding on its surface. Wash with soft soap and water; then apply, for an ointment, yellow wax 2 oz., sweet oil 8 oz.; melt together, and add sugar of lead in very fine powder 2 dr.; use a little after each bathing. Give bran mash, a diuretic ball, every 3d or 4th day, at the same time having green food, if possible. If not attended to, the inflammation extends and the heel cracks; poultice it with carrots boiled soft, or with linseed meal; apply the following caustic, — bluestone 2 dr., alum 2 dr., water 1 pt. When the inflammation has subsided, leave off the poultice, and apply, for an ointment, yellow resin 4 oz., do. wax 4 oz., sweet oil 1 qt.; melt together, and add calamine in very fine powder $\frac{1}{2}$ lb., — stir till cold.

Griping. — Mix senna-leaves 12 oz., guaiacum-wood 2 oz., elecampane-root 2 oz., aniseed 2 oz., caraway do. 2 oz., coriander do. 2 oz., stick-liquorice 2 oz., stoned raisins 8 oz., rectified spirits of wine 3 pts., soft water 3 pts. Let this mixture stand two weeks, occasionally shaking it; dose for a *Calf*, 2 or 3 table-spoonfuls, — for a *Horse*, $\frac{1}{2}$ pt.

Grogginess. — In *Horses*, a peculiar knuckling over of the fetlock-joint, and tottering of the fore-leg. No cure.

Heart, Inflammation of. — Not common. The only remedy is copious bleeding. It is indicated by quick pulse, rapid action of the heart, heard even at a distance.

Healing Dogs' Ears. — Melt together yellow resin 2 oz., do. wax 1 oz., sweet oil $\frac{1}{2}$ pt., and when it begins to cool, stir in 4 oz. powdered calamine; apply it to the sores.

Hide-bound. — Hardness of the skin of the *Horse*. If there be no other disease, give a mild physic-ball, of Barbadoes aloes 5 to 6 dr., powdered

ginger 2 dr., Castile soap 2 dr., treacle sufficient to form a ball. After this has operated, give every day, with bran mashes, green food, regular exercise, and good grooming, a ball made of powdered black antimony 2 oz., do. nitre 2 oz., do. yellow resin 1 oz., do. gentian 2 oz., flour of sulphur 2 oz., treacle sufficient to make eight balls.

Hoove. — Symptoms in *Cattle*, — the animal ceases to eat, is distressed, breath oppressed, moaning, belly blown up; brain is next affected, tongue protrudes. Introduce, as often as the belly swells, an elastic pipe down the throat into the stomach, which liberates the gas and relieves the animal; when relieved, give a dose of Epsom salts 1 lb., caraway seeds 2 oz., ginger $\frac{1}{2}$ oz., gruel 3 pts., and then, to give tone to the stomach, for three or four mornings, give a dose of Epsom salts 4 oz., powdered gentian 1 oz., do. ginger $\frac{1}{2}$ oz., do. caraway 1 oz., gruel 3 pts. In *Calves*, — introduce the elastic pipe. In *Sheep*, use the elastic pipe, or probang, same as for cattle, and give a dose of Epsom salts 2 oz., powdered ginger 1 dr., caraway 2 dr., in $\frac{1}{4}$ pint of warm water.

Hydrocephalus, or Water in the Head, in Sheep. — Give moderate doses of Epsom salts combined with ginger and gentian; for a *Sheep*, the dose may be — Epsom salts 2 oz., gentian 1 dr., ginger $\frac{1}{2}$ dr., in a $\frac{1}{4}$ pt. warm water.

Jaundice, or Yellows. — Symptoms in *Cattle*, — yellow eyes, urine, and skin. If there be fever, bleed lightly, and then give Epsom salts 1 lb., powdered ginger 4 dr., warm water 3 pts.; after the bowels are well opened, give every day, for a purge, madder 1 oz., flour of sulphur 2 oz., powdered caraway seeds 1 oz., Epsom salts 2 to 4 oz., warm water 3 pts. In *Sheep*, — give repeatedly, for a purge, Epsom salts 2 oz., powdered ginger $\frac{1}{2}$ dr., do. aniseed 2 dr., warm water $\frac{1}{4}$ pt.; if this be too weakening, give powdered gentian 2 dr., do. bark 1 dr., do. ginger $\frac{1}{2}$ dr., warm water $\frac{1}{4}$ pt.

Joint Felon, or Rheumatism. — Give for a drench, to keep the bowels open, Epsom salts $\frac{1}{2}$ lb., powdered caraway seeds 1 oz., flour of sulphur 4 oz., warm water 1 qt.; also give, once or twice a day, tartar emetic 1 dr., camphor $\frac{1}{2}$ dr., nitre 2 dr., aniseed powder 1 oz., well rubbed together, and given in 1 qt. thick gruel; if the joints continue much swollen, use for a liniment — spirits of hartshorn 2 oz., opodeldoc 2 oz., camphor liniment 4 oz., laudanum 1 oz., — mix for use.

Kicks, and other Bruises. — Foment the parts freely with hot water; if the skin is broken, apply a tincture of friar's balsam 2 oz., tinct. of aloes and myrrh 2 oz., — mix for use.

Kidneys, Inflammation of. — In *Horses*, — bleed freely, every 6 hours, if requisite; and give for a ball, Barbadoes aloes 8 to 10 dr., powdered ginger 2 dr., treacle sufficient to form a ball; the operation of the physic to be as

sisted by injections of warm water and $\frac{1}{2}$ pt. linseed oil, frequently thrown up, the loins well fomented with hot water, and afterwards apply a mustard poultice, with bran mashes and linseed tea.

Lameness of Shoulder. — Foment frequently with hot water, bleed a little from the plate vein, and give a dose of physic; and in obstinate cases apply a blister, or a liniment of opodeldoc 4 oz., laudanum 1 oz., sweet oil 4 oz., spirits of hartshorn 4 oz., — mix, and after each fomenting with hot water, rub well in.

Lampas. — In *Horses*, — a swelling of some of the bars of the mouth. Give a few mashes, aided by a gentle alterative; in need, make a few moderate cuts across the bars.

Lice in Cattle. — Result from poor keep. Use, for ointment, strong mercurial ointment 2 oz., lard $\frac{3}{4}$ lb., — mix, and rub where the lice are found.

Liver, Inflammation of. — Symptoms — fever, reclining on the right side, fulness on that side of the belly; urine yellow or brown, and sometimes bloody. If there is much fever, bleed a little, and give — calomel 1 dr., powdered opium 10 gr., do. ginger 2 dr.; rub together, and give in 1 qt. gruel, and repeat it twice a day; give, in 6 hours after first dose, a purge of Epsom salts 8 oz., water 1 qt.; dissolve and add linseed oil 1 pt.; repeat till the bowels are open. If purging takes place from the first, give the calomel, opium and ginger, and give the drench as in diarrhœa, at the same time blistering the right side; if great weakness ensue, give, for a tonic, powdered gentian $\frac{1}{2}$ oz., do. caraway seeds 1 oz., do. aniseed 1 oz., Epsom salts 4 oz., — mix, and give in 1 pt. warm brandy. For *Sheep*, bleed moderately, and keep the bowels open by a drench made of Epsom salts 2 oz., powdered ginger 1 dr., warm water 4 oz.

Locked Jaw. — In *Horses*, — bleed till the circulation is evidently affected, so as to administer a strong purging ball or drink, assisted by injections of one pt. linseed oil to one gal. warm water, at the same time applying a strong blister from the poll to the rump, and even on the side; when the physic begins to act, give an anti-spasmodic of powdered opium 1 dr., do. aniseed 2 dr., camphor 1 dr.; rub the camphor down with a little spirit of wine, and mix with the opium and aniseed, and beat into a ball with treacle. In *Cattle*, — bleed till the beast threatens to fall, and give, for a drink, Epsom salts $1\frac{1}{2}$ lb., flour of sulphur $\frac{1}{2}$ lb., warm water 2 qts., — mix, and repeat in $\frac{1}{2}$ lb. doses every 6 hours, assisted by injections every 4 hours, composed of Epsom salts $\frac{1}{2}$ lb., linseed oil $\frac{1}{2}$ pt., warm water 4 qts.; when well operated, give 1 dr. opium, dissolved in warm water, twice a day, and put a seton in the dewlap. For *Sheep*, — bleeding, and physic, — either Epsom salts or linseed oil.

Mallenders and Sallenders. — A scurfy eruption in the legs of horses.

Give a diuretic ball every third night, and dress twice a day with ointment made of tar 4 oz., suet 4 oz., — melt together, and add sugar of lead 1 oz — stir till cold.

Mange. — For a *Horse*, give a physic-ball of Barbadoes aloes 6 dr., calome 1 dr., powdered ginger 2 dr., Castile soap 2 dr., oil of caraway 20 drops, treacle sufficient to form a ball. After the mange has set, give the following alterative balls: powdered black antimony 2 oz., do. nitre 2 oz., Castile soap 2 oz., flour of sulphur 8 oz., soft soap enough to make the mass into 8 balls; give one of these every night, and use an ointment of flour of sulphur 8 oz., strong mercurial ointment 2 oz., soft soap 4 oz., train oil 1 pt.; rub well together, and then rub it in, with the hand, over the parts affected, using it moderately; repeat, and, if needful, add 2 oz. of spirits of tar. In *Cattle*, use a drench, of Epsom salts $\frac{1}{2}$ lb., flour of sulphur $\frac{1}{2}$ lb., — mix, and give in 3 pts. of thin gruel every third day, and use the same ointment as for horses. In *Dogs*, — mix for use, and rub in carefully, with the hand, upon the affected parts, an ointment of flour of sulphur 1 lb., soft soap 4 oz., oil of tar 1 oz., train oil $\frac{1}{2}$ pt.

Megrins in Horses. — Is the mildest form of determination of blood to the head. Give present relief by drawing a penknife deeply across the bars of the mouth, and set them bleeding; then wash well, and give a dose of physic, with green food. When the physic has operated, give every night an alterative ball, made of flour of sulphur 5 oz., powdered nitre 5 oz., do. resin $1\frac{1}{2}$ oz., do. black antimony 3 oz., liquorice and soft soap sufficient to make 12 balls.

Miscarriage. — In *Mares*, often arises from over-exertion, or accidents, or stinting in food, or high feeding and idleness. When, therefore, the beast is near her time, separate her from the rest, and put her in some convenient quiet place. When there is danger of slipping the calf, the cow should be taken from the pasture or stable the over-night, and from 2 to 3 or 4 qts. of blood drawn; and give for a purging drink, repeated in about 8 or 10 days, Epsom salts 1 lb., nitre 2 oz., ginger and aniseed, in powder, 1 oz. each, treacle 4 oz.; pour 3 pts. hot water upon these, and give when new-milk warm; after it operates, give for one drink, — alum in powder 4 oz., nitre 1 oz., grains of paradise, and aniseeds, fresh powdered, 1 oz. each, solid opium cut small $\frac{1}{2}$ dr., treacle 4 table-spoonfuls; put this into a pitcher, pour 1 qt. hot water upon it, cover it down till new-milk warm, and then give it to the beast. If the calf is slipped, separate the cow from the herd, and give, for a drink, spermaceti 2 oz., spirits of turpentine 1 oz., one egg-yolk; beat these together, then add grains of paradise, and caraway seeds, fresh powdered, 1 oz. each, treacle 4 oz., — mix in 1 qt. warm gruel, add a wine-glass of gin, and give it, new-milk warm, every third day, for 3 times. In *Sheep*, must be prevented,

as in the two former cases, by careful attention to their habits, feed, and condition. If the ewe is afterwards attacked with fever, she may be treated as for fever; if very weak, give doses of ginger 2 dr., gentian 1 dr., Epsom salts 1 oz., in warm water.

Nasal Gleet. — In *Horses*, give a ball, night and morning, made of blue vitriol 1 dr., dissolved in water; powdered gentian 2 dr., do. ginger 1 dr.; treacle and meal enough to form a ball. Inject the nose with a solution of chloride of lime.

Navel Ill. — When the navel bleeds, tie a ligature a short distance from the belly; a pledget of lint, dipped in friar's balsam, over it, confined with a bandage, and changed night and morning; and keep the bowels open with linseed oil; then give a cordial drink, in a little gruel, once a day, made of powdered caraway 2 dr., do. gentian 1 dr., do. ginger $\frac{1}{2}$ dr.

Palsy. — In the *Horse*, if from violence or accident, give a dose of physic, foment the back or loins with hot water, and rub in, for an ointment, opodeldoc 4 oz., spirits of turpentine 4 oz., do. of hartshorn 4 oz., mixed together; if necessary, after three or four days, apply a mustard liniment. In *Cattle*, keep the bowels well open by a drench made of Epsom salts 1 lb., powdered caraway 1 oz., do. aniseed 1 oz., do. ginger 2 dr., — mix, and give in 1 qt. warm beer, and use same liniment as for horses. In *Sheep*, keep the bowels well open with a drink of Epsom salts 2 oz., warm water 3 oz.; dissolve, and add linseed oil 1 oz., — mix together.

(*Pigs, Diseases of.*) — For the common diseases of pigs, give flour of sulphur 1 lb., madder $\frac{1}{2}$ lb., powdered nitre $\frac{1}{4}$ lb., do. black antimony 2 oz., — mix, and give one or two table-spoonfuls in their food for a dose.

Pneumonia, or Inflammation of the Lungs. — In *Horses*, bleed freely till fainting begins; then give, for a fever-ball, tartar emetic 1 dr., powdered foxglove $\frac{1}{2}$ dr., do. nitre 3 dr., linseed meal and soft soap enough to form a ball, to be given two or three times daily. After the force of the fever is reduced, it may be necessary to apply extensive blisters to the brisket, and to the sides under the elbows, the hair being shaved close, and the ointment made of powdered Spanish flies 1 part, lard 4 parts, resin 1 part; melt the lard and resin together, then add the Spanish flies, and rub the ointment well in with the hands for $\frac{1}{4}$ of an hour. In *Cattle*, the treatment is similar; bleed freely, and, if needful, repeatedly; give a dose of salts, and then the following — tartar emetic 1 dr., camphor 1 dr., nitre 4 dr., in 1 qt. thick gruel. If the blister-ointment fails, hot water and a hot iron may be used.

Poisons. — For *Cattle*, affected by the yew-tree, hemlock, dropwort, black henbane, and wild parsnip, give 1 lb. Epsom salts in 2 qts water; use the stomach-pump, injecting and copiously withdrawing water. Symptoms

— sudden swelling, thirst, refusal of solid food, grinding of the teeth, pawing, and rolling as in pain.

Poll Evil. — First bleed, administer a dose of physic, and apply cold lotions. If these fail, use poultices and warm fomentations, and then introduce a seton skilfully.

Ring-bone. — In *Horses*, an enlargement of the postern joint; — apply a blister over the ring-bone, formed of powdered cantharides 1 oz., resin ointment 4 oz., — mix for use.

Rheumatism. — In *Dogs*, use for an embrocation, camphorated oil 2 oz., spirits of hartshorn 1 oz., laudanum $\frac{1}{2}$ oz., — mix for use.

Roaring. — In the early stages, a blister, bleeding, cooling medicine, may succeed in recovering; when confirmed, it is cureless. It is an unnatural contraction of the windpipe and larynx.

Rot. — An affection of the lungs and liver, with a dropsical tendency. Symptoms, — if, in warm, sultry, and rainy weather, sheep that are grazing on low and moist lands feed rapidly, and some of them die suddenly, there is reason to fear that they have contracted the rot; this suspicion will be further increased, if, in a few weeks afterwards, the sheep begin to shrink, and become flaccid in their loins, — by pressure about the hips at this time a crackling is sometimes perceptible; now, or soon after, the countenance looks pale, the skin is pale red, and the wool easily separates from the felt, and, as the disorder advances, the skin becomes dappled with yellow or black spots; about this time, the eye loses its lustre, becoming white and pearly, and to this succeed debility and emaciation. For a cure, both turpentine and common salt have sometimes been used with success; the latter is good to prevent, as also are aromatic vegetable substances, — parsley, for instance, — also give them, when feeding on watery plants, some hay, corn, or oil-cake.

Round-bone, Sprain of. — Foment well and often with hot water, then blister.

Saddle-galls, Sit-fasts and Warbles. — Allow no pressure on the parts affected; then dress with common salt dissolved in water, and the brine mixed with one fourth its bulk of friar's balsam.

Scab in Sheep. — This is owing to the presence of minute insects. Use for a lotion, corrosive sublimate 1 oz., sal-ammoniac 4 oz., spirits of turpentine 1 pt., hot water 2 gal. Dissolve the sublimate and sal-ammoniac in the water, and then add the turpentine; separate the wool, remove the scab, and apply the lotion.

Scour in Lambs. — Mix, and give one or two table-spoonfuls once or twice a day, — prepared chalk 2 oz., powdered canella bark 2 dr., tincture of catechu $\frac{1}{2}$ oz., laudanum $\frac{1}{2}$ oz., water 1 pt.

Sore Teats in Cows. — Before milking, bathe the teats well with warm water; after milking, use for an ointment, wax 2 oz., lard 6 oz., — melt together, and add sugar of lead in very fine powder 2 dr.; stir till cold.

Splint. — Caused by inflammation of the shank-bone: its growth is attended by heat, tenderness, and pain. If it produce lameness, cut the hair off close, and rub in, for three or four nights, a little strong mercurial ointment; then blister the part with blister ointment, and repeat it if necessary. When the inflammation from the blister has subsided, turn him out.

Staling, Difficulty. — In the *Horse*, give bran mashes, green food, and plenty of gruel; if this fails, take a little blood, and give a mild dose of physic.

Staling, Profuse; or, Diabetes. — In *Horses*, bleed, give a dose of physic, and then twice a day give an astringent ball, made of powdered bark $\frac{1}{2}$ oz., do. opium $\frac{1}{2}$ dr., do. coriander 2 dr., treacle enough to form a ball; give green food, or a few carrots.

Stifle Lameness. — Foment frequently with hot water; give a mild dose of physic, and let the animal rest.

Strangles. — Symptoms, — a cough, discharge from the nostrils, and also one of a soapy nature from the mouth, swelling under the throat, loss of appetite, fever. Give mashes and green food, and apply to the throat, over the tumor, a blister of powdered cantharides 1 oz., yellow basilicon 4 oz. oil of thyme 2 dr., — mix for use. When the tumor has formed, open it with a lancet, and dress with a tincture of friar's balsam 2 oz., tincture of myrrh and aloes 2 oz., — mix. When the tumor begins to heal, give a mild dose of physic. It is not often necessary to give medicine, if much fever exists. At the commencement of the disease, give, for a ball, tartar emetic 4 dr., powdered nitre 16 dr., linseed meal and soft soap enough to make 4 balls.

Surfeit. — A skin complaint in horses. Bleed a little, give mashes and green food, and a ball, made of — powdered black antimony 2 oz., do. nitre 2 oz., do. resin 1 oz., do. gentian root 2 oz., flour of sulphur 4 oz., soft soap enough to make 8 balls.

Swelled Legs. — Give regular exercise, and assist by hand-rubbing, and by bandages wrapped rather tightly around the legs. Give no diuretic balls.

Thick-wind. — Feed moderately, give green food occasionally, and gentle exercise.

Thorough-pin. — In *Horses*, a swelling above the hock. Apply a blister.

Ticks or Lice in Sheep. — Apply carefully, for a wash, powdered arsenic $\frac{1}{2}$ lb., soft soap 7 lbs., soft water 4 gals.; boil this till the arsenic is dissolved, and add as much soft water as will dip 50 to 70 sheep.

Turnsick, or Goggles, or Giddy, or Dunt. — A complaint of the head,

proceeding from the presence of hydatids in the brain, lodged in a sac or bladder, which presses upon the brain. It is beyond the reach of medicine or mechanical operations. *Sturdy* is a name often given to this disease, as well as to Water in the Head, but they are distinct. Treat by examining the skull for a soft spot on the bone, where the water is collected. Perforate the skull with a trocar, accompanied by a tube, through which the water may escape; after which, apply a few drops of essence of myrrh to the aperture; shelter the animal and dress the wound.

Ulcers. — Bathe 2 or 3 times a day, with a solution of chloride of lime, and use an ointment of yellow basilicon 4 oz., powdered verdigris $\frac{1}{2}$ oz.; rub together for use.

Warbles. — Foment with hot water, and when the tenderness has abated, apply a lotion, of strong vinegar 1 pt., rectified spirit of wine 2 oz., extract of Goulard 1 oz., spirits of turpentine 1 oz., — mix together for use.

Warts. — Cut them off close with a pair of scissors, and touch the roots with lunar caustic.

Womb Inflammation. — It occurs in *Cows*, after calving or bulling. Symptoms, — great irritation and pain. Bleed, and give for a drench, Epsom salts 1 lb., powdered caraway seeds 2 oz., warm gruel 3 pints. Bathe the womb with Goulard water, or vinegar and water mixed equally. In *Sheep*, bleed and open the bowels with Epsom salts in 2 oz. doses.

Worms. — In the *Horse*, unless they abound, let them remain. If they descend into the rectum, inject a quart of linseed oil, or salt and water. If a strong dose of physic is intended to be given to the patient, when it has set, give a ball every morning, fasting for a week, of tartar emetic 8 dr., flour of sulphur 6 oz., powdered ginger 8 dr., treacle sufficient to make 8 balls. In *Dogs*, give, for a drench, spirits turpentine 1 to 4 dr., castor-oil 2 to 8 dr., — mix for a dose according to size.

Wounds. — Foment frequently with hot water, and apply a tincture of friar's balsam 2 oz., compound tincture of myrrh and aloes 2 oz.; if unhealthy granulations arise, wash, previously to using the tincture, with bluestone 1 oz., soft water 1 pt. Wounds generally heal better without sewing, if it can be avoided. For *Dogs*, tincture of myrrh and aloes 2 oz., friar's balsam 1 oz., — mix these together, for use.

LIVE STOCK CALENDAR.

NOVEMBER. — The month of November may be said to be the commencement of the farmer's year. By this time the labors of his harvest have been concluded, and his produce has been secured; and he is now proceeding to prepare the ground for the crop of another season, if the weather be sufficiently open for him to do anything more before the next spring.

The cattle may be supposed to consist of cows ; of a certain number of calves ; of a certain number of the steers and heifers of the preceding year, termed, therefore, one-year-olds, as having completed their first year, but now approaching to the end of their second year ; of a certain number of steers and heifers which have completed their second year, and are therefore termed two-year-olds, though now approaching the end of their third year ; and of a bull. The two-year-old steers and heifers are now arrived at maturity ; the heifers intended for breeding have received the male in the course of the season, and the older steers are ready for final breeding.

As the month of October had advanced, the pasture had begun to fail ; and before the termination of the month, the various cattle had been put in their respective houses, yards, and stalls. The cows which had borne calves in the early part of the year had been put in the cow-house and tied in their respective stalls, — straw, and a limited proportion of succulent food, as turnips, having been supplied to them. The calves which were born in the early part of the year had been put in one or more yards with sheds, had been well littered, and had received straw, and a full allowance of turnips.

The steers and heifers of the preceding year, now turned their first year, and approaching the end of their second year, had also been put into yards with sheds. They had likewise been plentifully littered, receiving straw, with a full allowance of turnips.

The older cattle — those that have completed their second year — had been treated thus : — Such of them as were heifers, to be retained for breeding, had been separated from the males in the preceding spring ; had received the male as they came into season, in spring and the early part of summer ; and, being with calf, had been put into yards with sheds, to be tied to their respective stalls, when within a few weeks of calving. The steers again, which are now to be finally fattened, had either been tied in stalls, or put in pairs into yards with sheds, in either case receiving a full supply of turnips, or other nourishing food.

The bull had been put into a shed or yard by himself, receiving straw for provender, and a sufficient supply of turnips.

Such may be supposed to be the arrangement of the cattle at the commencement of the month of November. The same treatment with respect to them is to be continued during the entire month ; — the cows and heifers are to receive straw, with a modified allowance of turnips — the calves and steers straw, with a full supply of turnips.

The sheep again, consisting, it may be assumed, of a regular breeding-stock of ewes, may be supposed to have been arranged and treated thus : — The ewes, consisting partly of sheep that had borne lambs, had, by the 10th of October, the rams admitted to them. At the beginning of November the

ram. and ewes are still pasturing together, receiving no other food but grass, and by the middle of the month the rams are withdrawn.

The lambs born in the spring, now termed ewe and wether hogs, had, on the failure of the pastures in October, been penned on turnips. At the beginning of November, they continued penned on turnips, they being attended to as well as the sheep, and the pens being shifted when necessary.

The horses, in the month of October, had been put upon their full allowance of hay and corn. At the beginning of November they are receiving full feeding ; but before the middle of the month, when the hours of labor become short, the hay may be withdrawn, and the allowance of oats reduced one half.

By the beginning of the month the colts had been put into their yards, or into a paddock with a shed, receiving straw as provender, with any succulent roots, as turnips and potatoes.

The swine and poultry are receiving their usual food. The pigs are fattened at all times, and the poultry receive their regular supplies of food in their yard ; and as the same method of management continues throughout the year, the feeding of this class of stock need not be again adverted to.

DECEMBER. — The cows are in the cow-houses ; the young cattle in their yards ; the feeding cattle in their houses or yards, as before ; and they are all kept and treated in the same manner throughout the month. The ewes are, as before, on grass ; but in snows, or hard frosts, they receive an allowance of hay. The ewe and wether hogs are penned on turnips as before, and are kept so during the month. The hours of daylight, and consequently of labor, being short, the horses are still fed on straw, and receive their modified allowance of corn. The colts are in their yard or paddock, receiving straw, with an allowance of green food, and are kept so during the month.

JANUARY. — The cattle are still in their houses and yards, and are fed as during the last month ; turnips being brought, and a store kept in reserve, as formerly. Some of the cows may calve during this month, or towards the end of it. They are to be well attended to at this time, and the calves separated from them at the birth, and fed on new milk three times in the day. The ewes are on grass-land, if the weather be not too severe, receiving hay when the weather renders it necessary. The ewe and wether hogs continue penned on turnips, as during the previous month. The horses are on straw, and are receiving their short allowance of corn. The colts are in their yard or paddock, and are fed as before.

FEBRUARY. — The cattle are in their houses and yards, and are fed as during the last month. The cows will calve during this month, and must be carefully attended to. The ewes are on grass, if the weather is not too

rigorous ; and after the middle of the month, they may have turnips carried to them, so as to prepare them for the lambing season by the middle of next month. The ewe and wether hogs are penned on turnips as before. By the middle of the month, if not sooner, the horses should be put upon hay, and receive their full allowance of corn, in preparation for their work in spring. In place of straw, the colts may now receive hay.

MARCH. — The cattle are still in their yards, and feeding as before. During the month all the cows may be supposed to have calved. The additional calves required are to be purchased, the best and earliest that can be obtained. The ewe and wether hogs are on turnips, as before. The ewes will now begin to lamb. They have been hitherto receiving turnips, but as they lamb they are transferred with their young to new grass. The male lambs are castrated in lots. The horses are on full work, and are receiving their full allowance of hay and corn. The colts are receiving hay.

APRIL. — The cattle are in their yards, and fed as before ; the calves are receiving milk, with such nourishing substances in addition as may enable the milk of each cow to bring up two calves. The ewes are now on new grass, with their lambs. At the commencement of the month, the ewe and wether hogs are still on turnips, but by the middle of the month they are removed from turnips and put on grass. The horses are at full work, and receive a full supply of hay and corn. The colts that have reached their third year may now be taken up and trained to work ; or they may be allowed another summer's grass, and be taken up for training in autumn. Mares will foal this month.

MAY. — At the commencement of this month, the cattle may yet be in their yards, and be fed as formerly. By the middle of the month, the former year's calves, now yearling steers, and the two-year-old steers, if the grass is sufficiently advanced, are turned out to pasture ; the cows are turned out to pasture, and if there are any of the two-year-old cattle which are heifers from which it is wished to breed, they must be separated from the steers of the same age, and placed amongst the cows, and when they come into season, if they have not already done so, they must receive the male. During this month, the older cows should all have received the male, so that they may calve in the following February. With respect to the feeding oxen now turned their third year, and consequently three-year-olds, these may be fed during the month, as long as there are turnips sufficient for them. During this month, the mares should all have received the male, so that they may foal in the subsequent month of April. The colts are turned out for the season to grass. As the weather becomes warm, the sucking calves may be turned out to a small paddock. After being weaned in their fourth month, they are turned out to feed for the remainder of the season, along

with the cows and feeding stock. The sheep of all kinds, at the commencement of the month, were on grass, and they continue to be pastured in their respective fields during the month. By the end of it, the fat sheep, if ready, may be washed and shorn, or else these operations are deferred till later in the season.

JUNE. — The cows and steers are pastured in the field during the month. All the calves will be weaned during this month, and turned out to graze for the remainder of the season. Such of the cows, heifers, and mares, as have not received the male, now receive him. At the beginning of the month the horses should receive green forage, and towards the middle of it they may be put at night in the pasture-field. At the beginning of the month, the ewes with their lambs, and the ewe and wether hogs, are at grass in their respective enclosures; and at or before the beginning of the month, they are washed, and in eight days afterwards shorn. In ten days, or as soon as convenient after shearing, the wether-hogs, now dinmons, and such of the ewe-hogs, now gimmers, as are not to be retained on the farm for breeding, may be sold.

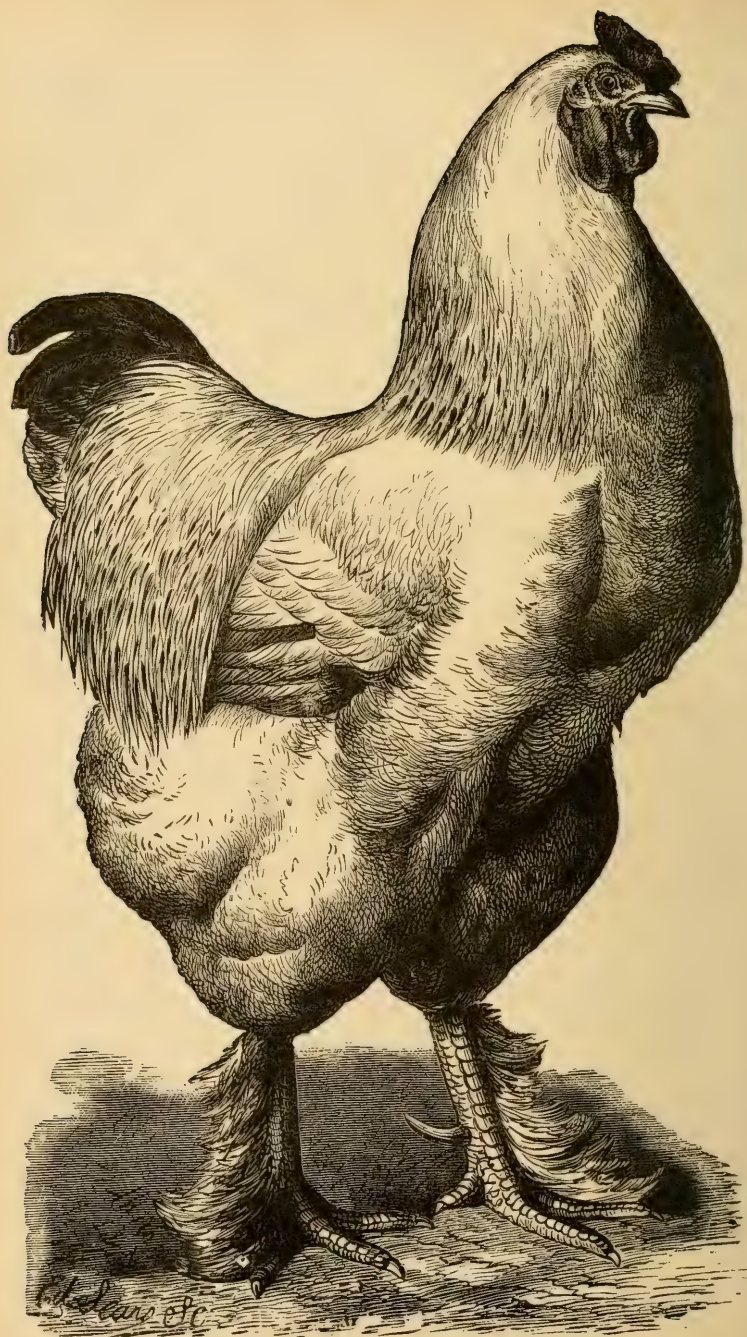
JULY. — The cows, oxen, and weaned calves, are at grass, and are kept so during the month. The horses continue to receive green forage during the day, and may be permitted to pasture in the fields at night; and this method of feeding may be continued during the month. But their work having become easy towards the middle of the month, their allowance of corn may be lessened. At the commencement of the month the ewes, with their lambs, are in their former fields of grass; by the middle of the month the lambs are weaned; and from this time forward, the lambs, now termed hogs, are kept separate from the breeding ewes.

AUGUST. — The cows, steers, and calves, are at grass, and are kept so during the month. The ewes are at grass in their own fields, and the ewe and wether hogs in theirs. The old ewes that are to be sold may now be selected from the rest of the flock, and marked for that purpose; and, at the same time, all the other sheep may have their distinguishing mark put upon them. The horses are receiving green forage, and, when the first crop of clover is consumed, other feed may be furnished. They may still be allowed to be in the fields at night.

SEPTEMBER. — The cows, calves, and steers, are all at grass, and are kept so during the month. All the sheep are likewise at grass during the month; but before the end of it, the old ewes which had been marked for sale may be sold. The horses are kept on green forage. As the month advances, they are taken up from grass at night, and kept in the stable; and, at the end of the month, they are put again on hay and hard food.

OCTOBER. — At the beginning of the month, the cows, calves, and steers,

are at grass; but as the month advances, the cows may be taken up at night, and receive green forage in the house. Before the 10th of the month, the rams are admitted to the ewes and gimmers. At the commencement of the month, the ewe and wether hogs are at grass, but towards the end of it, when the pastures fail, they are penned on turnips. Towards the end of the month, too, as the pastures fail, the cows, calves, and steers, are put finally into their respective winter houses and yards.



CHAPTER VIII.

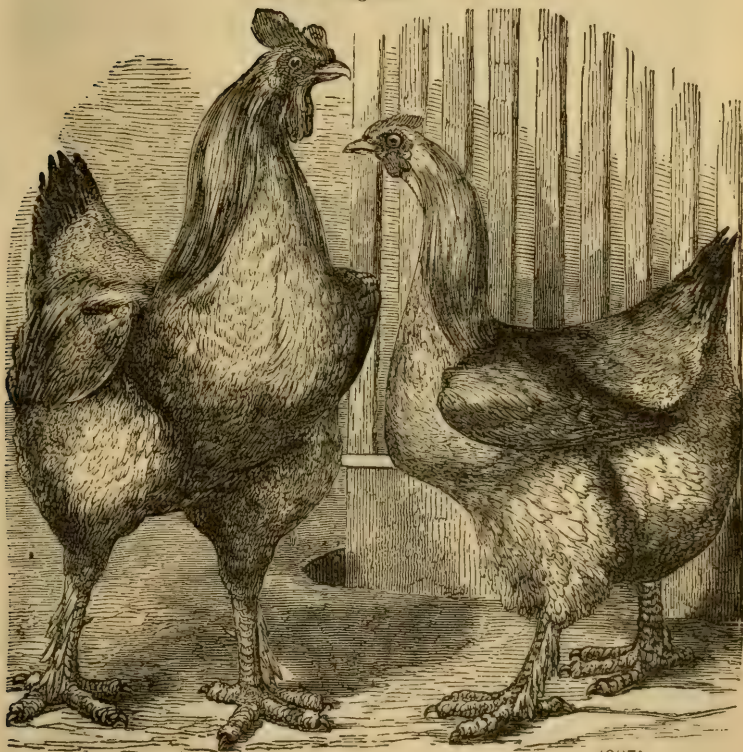
POULTRY, OR THE VARIOUS DOMESTIC FOWLS.

THE RAISING, BREEDING, DISEASES, AND TREATMENT, OF THE COMMON BARN FOWLS: ALSO, THE TURKEY—THE GOOSE—THE DUCK, ETC., IN ALL THEIR IMPORTANT VARIETIES.

I. COMMON BARN FOWLS.

VARIETIES.

Fig. 227.



SHANGHAI (Fig. 227).—The preceding very excellent representations are actual portraits, drawn from life. They were imported by William C. Rudman, of Philadelphia, from whom they were purchased by W. J. McGowan.

The cock, 15 months old, weighed 12 pounds, and the hen, 11 months old, weighed $9\frac{3}{4}$ pounds.

BANKIVA.—This fowl is a native of Java, has a red indented comb, red wattles, and ash-gray legs and feet. The cock has a thin indented or scalloped comb, and wattles under the mouth; the tail a little elevated above the level of the rump, and the feathers disposed somewhat in the form of tiles. Neck-feathers long, hanging, rounded at the tips, and of the finest gold color; head and neck fawn color; wing-coverts are dusky-brownish and black; tail and belly black. The hen is of a dusky ash-gray and yellowish color, comb and beard much smaller than the cock, with no feathers on the neck besides the long hackles. The annexed cut represents a cock of this variety.

Fig. 228.



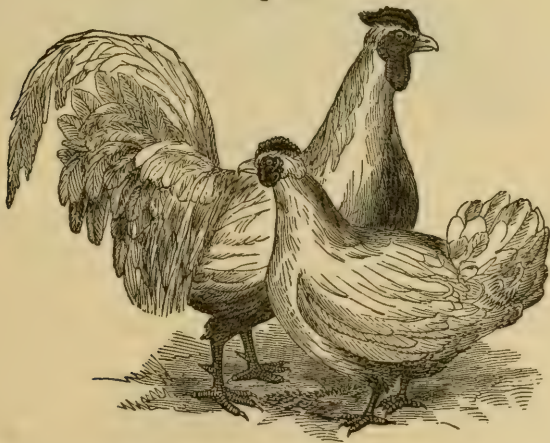
DUNGHILL — This is the commonest form of the domestic fowl. The cock

has a large thin comb and wattles, and the brilliant plumage of the wild species ; but the best hens are generally of dingy colors, though there is almost infinite variety in their shades ; the white ones are better for the table than for laying. The legs of the common fowls should be short, white, and shining, and their bodies round and plump.

GAME. — This kind of fowl is rather slender in the body, neck, bill and legs, and the colors, particularly of the cock, very bright and showy. The flesh is white, tender, and delicate, and the eggs small, but, like the flesh, much esteemed for superior delicacy ; and therefore, for more reasons than one, it would be better to raise them for domestic use than for the cock-pit.

DORKING. — This valuable variety has acquired a great popularity, and is easily distinguished. Their flesh is exceedingly juicy, white, and delicate, and they have the advantage of feeding rapidly, and growing to a very large size, when properly managed. Capons and poulardes are fre-

Fig. 229.



quently made of these fowls, growing to an enormous size when castrated. The feathers are almost always white, and their legs short and remarkably smooth.

MALAY, OR CHITTAGONG. — These fowls have remarkably long legs and large bones ; their flesh is, however, finely flavored, when they have been properly fattened, and their eggs are so large and rich that two of them are equal to three of those of ordinary fowls. The color of the feathers is black, or very dark brown, streaked with yellow, and the legs are large and coarse

The fowls are tall, strong-beaked, and powerful ; the cock has a loud and harsh crow. It is said that a cross breed between the Malay and the common fowl produces a breed very superior to either of its progenitors.

PADUAN, OR JAGO. — There are numerous hybrids and varieties of the Jago fowl, one of the most interesting being the Spanish fowl, represented in the following figure. The body and tail feathers are of a rich black

Fig. 230.

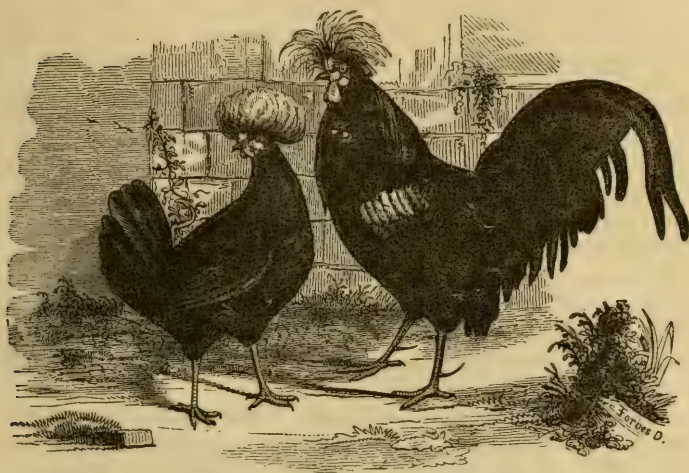


with occasionally a little white on the breast. The cock is a most majestic bird ; its deportment grave and stately ; and it is encircled with a ring of brown feathers, from which rises a black tuft which covers the ears. There are similar feathers behind the comb, and beneath the wattles. The legs and feet are of lead-color, except the sole of the foot, which is yellowish. The every-day or ever-laying fowls are the same as the *Hamborough*, or *Dutch*. They are, however, evidently only a variety, or hybrid, of the Jago fowl, with the nourishment that was required in that species, and in some of its varieties, to form a tuft of feathers, expended in an enormous comb and wattles. These fowls are very large, their feathers blackish, with an iridescent green. The wattles and combs, even of the hens, are unusually large, and the caps under the ears are very large, and of a bluish white.

CRESTED. — This variety is known by a densely-tufted crest and a small comb ; it is also variegated with fine colors, but it agrees in other respects with the common dunghill fowl. The different varieties of this fowl are the white fowl with a black crest, the black fowl with a white crest, and the white fowl with a large beard. Of these the *Poland* or *Polish* fowl, repre-

sented below, is the best known, and it appears probable that it is a hybrid between the Crested and the Spanish fowls. These fowls are very hand-

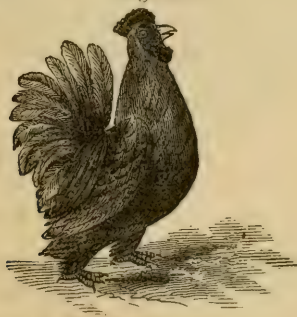
Fig. 231.



some, and excellent for the table; the hens are good layers, producing large and finely-flavored eggs, but they are bad sitters.

BANTAM.— This is a small variety, with short legs, most frequently feathered to the toes, so as sometimes to obstruct walking. The full-bred

Fig. 232.



Bantam cock should have a rose comb, a well-feathered tail, full hackles a proud, lively carriage, and ought not to weigh more than one pound 26

nankin-colored and the black are the greatest favorites. If of the latter color, the bird should have no feathers of any sort in his plumage. The nankin bird should have his feathers edged with black, his wings barred with purple, his tail-feathers black, his hackles slightly studded with purple, and his breast black, with white edges to the feathers. The hens should be small, clean-legged, and match in plumage with the cock.

DWARF, OR CREEPER. — This variety, which is not larger than a pigeon, differs from the bantam chiefly in size and in the shortness of its legs. The Acaho is very small, with a circle of feathers about the legs, a thick tail, which it carries straight, and the ends of the wings black. In addition to this, there are some who are obliged to leap, from their legs being so short; they are the size of a dunghill fowl, and kept as being very fruitful; the hens will hatch thirty eggs at a time.

RUMKIN. — This is now considered a distinct species. It is distinguished by the want of a tail, by the comb not being, in the wild birds, indented, and by the wattles being blood-colored rather than scarlet; the feathers are all of a dusky orange in the wild birds, but finely variegated in the tame ones.

FRIZZLED. — A native of Java and Japan. Distinguished by having all the feathers turned and frizzled, being smaller than our common species, more wild, and less suitable for domestic purposes. Flesh firm and delicate.

SILKY. — This is also a distinct species, according to modern writers. It has the whole body covered with feathers, the webs of which are so disunited as to appear like hairs or glossy silk; the general color is white, and the legs covered wholly on the outside, quite to the toes. As in other varieties, individuals of this sort differ in respect to color.

RUSSIAN, OR SIBERIAN. — This breed seems to differ chiefly from others in having considerable tufts of brown or dark loose feathers springing from each jaw, and others, longer or fuller, from the lower jaw. In the hen there is an upright tuft, spreading from the back of the head, of the same silky texture. Independently of these, the cock has the usual comb and wattles, and the hen a small comb also. This sort varies in color, one variety being white, with the ends of the feathers glossy blue or black, giving it a spotted appearance, and the legs being covered with fibrous or downy feathers; another has the plumage of the game fowl, a fine tawny orange, spotted with black.

BARBARY. — This African variety is generally of a pale or dun color, spotted about the neck sparingly with black, and the feathers at that part very full; on the crown is a large, full tuft of feathers, the same in color with the body.

JAVA — Resembling the Malay in shape, but somewhat colored like the

Dorking. It is probably a cross between the two. In qualities it resembles the Malay, but is not so valuable as a cross with other breeds.

OSTRICH, OR COCHIN CHINA. — This variety of fowls completely surpasses,

Fig. 233.

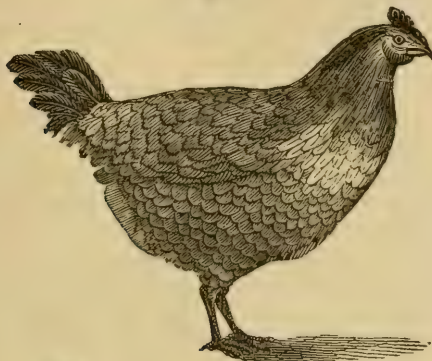


Fig. 234.



in size and power, the general run of poultry. Their general color is rich, glossy brown, deep bay ; on the breast is a marking of a blackish color,

and of the shape of a horse-shoe ; the comb is of a medium size, serrated, but not deeply so, and the wattles are double. Besides their gigantic size, however, these fowls possess other distinctive characteristics, the most striking of which is, that the wing is jointed so that the posterior half can, at pleasure, be doubled up, and brought forward between the anterior half and the body. The eggs are large, chocolate-colored, and of a very delicate flavor.

GENERAL TREATMENT.

Raising, Breeding, &c. — Hens, if left to their own impulses, would produce one brood early in spring, the other in autumn. They begin to lay in February, sooner or later, partly according to the time of molting, which means the shedding of the feathers, at which time they lose their high tone of health, and cease to lay. The season of molting is late in the autumn, and in consequence of the change in their constitution, while the juices of the body are promoting the growth of new feathers, no egg secretions are formed. The molting period, after the third year of the hen's life, becomes gradually later and more tedious ; young poultry molt in spring ; no fowl are fit for the table at such time. The hens lay abundantly in February and March, which are usually quite as cold as November and December, while in the latter, unless they have molted very early in autumn, they rarely yield an egg. Reaumur warmed his fowl-houses by artificial heat, but got no eggs. Yet a stock of poultry, by judicious treatment, may be rendered prolific during the entire year, by having very early and successive summer broods, as the pullets (which do not molt in the first year) will lay towards the close of the year. The first brood may be obtained in January, by careful management. *Hot food* — boiled potatoes are as good or better than any other — should always be given, in the winter months, to the hens which are on the laying list, and which should be kept as dry and warm as possible.

Number of Hens for a Cock. — Every experienced fowl-keeper knows that those eggs only are prolific which are produced by hens which have had constant intercourse with the male, though, for the purposes of the table, they are better without this intervention, as they are more easily preserved in a state of freshness. Some writers recommend twelve to twenty females for each cock, while others consider half that number more desirable. The fact is, much depends on climate, and the season of the year, a dry and genial temperature favoring a greater number of the hens to the male.

Qualities of a Good Cock. — In selecting a cock, he is considered to have every requisite quality, when he is of a good middling size ; when he carries his head high, has a quick, animated look, a strong and shrill voice short bill, a fine red comb, shining as if varnished, large wattles, and of the

same color as the comb, the breast broad, the wings strong, the plumage black, or obscure red, the thighs very muscular, the legs thick, and furnished with strong spurs, the claws rather bent, and sharply pointed. He ought also to be free in his motions, to crow frequently, and to scratch the ground frequently for worms, not so much for himself as for his hens. He ought, withal, to be brisk, spirited, ardent, and ready in caressing the hens, quick in defending them, attentive in soliciting them to eat, in keeping them together, and in assembling them at night.

Selecting Hens. — It is only requisite to have them of middling size, dark colored, bright eyes, short legs, blue feet, and neither disposed to crow nor be passionate. Hens that are long-legged, — and of course ill-formed for sitting, — with small body, and very limited compass of wings, should be kept, if kept at all, exclusively for laying. The best age is from two to four years.

Sitting. — The hen testifies her desire to hatch by making a clucking noise, searching for eggs to sit upon, and by general restlessness and feverish agitation. When this tendency is not naturally excited, some humane breeders endeavor to promote the disposition by stimulating applications — nettles, for instance — to the belly. Hens that have molted very early will often sit before November, and this is a point gained when chickens are wanted about Christmas. The eggs for hatching should be fresh, and free from all offensive smell, and preserved in bran, with their larger end — which contains the air-bag — uppermost, and under a warm temperature, for three weeks before they are set. Examine the eggs, by holding them between the eye and a candle, and if the vacancy caused by the air-bag at the blunt of the egg appears to be a little on one side, it will produce a hen; if this vacancy be exactly in the centre, it will produce a cock. From nine to fifteen is the number usually placed under the hen, according to her size. Her nest should be of clean, soft, and short straw, if possible on the floor, and facing the south, and corn and water should be placed within her reach; but the food should be removed as soon as she satisfies herself. Many hens feed but once a day, and some would starve themselves sooner than leave their eggs in search of food.

Hatching. — The hen sits for three weeks. About the twenty-first day the chicks chip the shell with the upper bill, which is furnished with a horny scale at the end, and gradually extricate themselves from confinement; frequently they do not disengage themselves from it in less than twenty-four hours, or even more; but it is generally much better not to assist them in breaking the shell, for if this be done before they have taken in the necessary supply of sustenance, by the yolk passing into their bodies through the navel, they will certainly die. It may, however, sometimes be necessary to afford them aid, for it sometimes happens that their bodies adhere, from

bad hatching, to the shell, and that their naturally revolving movements do not tend to disengage them. They must, in this case, be very tenderly relieved by the hand.

On the day after they have been hatched, the chicks may be removed from the nest to a basket, or some similar receptacle, lined with wool, or such soft, warm substance, though it is perhaps better not to remove them from the original nest. For a fortnight they are fed with crumbs of bread soaked in milk, and thenceforth every day, for some time, with yolks of eggs, curd, grits, &c., and after a few days they may be allowed to peck about in warm spots with their mother, but must be guarded from wet. They will soon feed greedily on meal, crumbs, &c., mixed with a small portion of potatoes, beet-leaves, parsley, or cabbage.

Fattening.—Fowls in a natural state, picking up what they can get at the barn-door, are, perhaps, the best-flavored and most wholesome for the table; but as it is common, and almost necessary, to practise fattening, we will treat of that matter.

The most approved coops are those which are divided into solitary chambers, so narrow as to prevent the fowl from turning around, and with an opening in the rear part for the discharge of the excrement, perfect cleanliness being indispensable, with meal and milk in a trough, and a little gravel or brick-dust, to promote digestion, at front. Another practice is, to cram them with a paste made of flour, or meal, milk, and hog's lard, or kitchen-grease, introduced by means of a tube, or by the fingers. In the course of a fortnight chickens may be rendered sufficiently fat, and of great weight.

Health of Fowls.—The indications of good health are, a florid color of the comb, and bright eyes free from moisture, dry nostrils, and bright, glossy plumage.

CAPONIZING.—This is an art but little understood in the United States, although a knowledge of the mode of performing it is of equally as much importance to the farmer as an acquaintance with the process of castrating cattle, horses, and swine. The emasculation of young roosters exerts a beneficial influence on their condition, rendering them large, fat, and fine-flavored. The fowls selected for the purpose should be of the largest breed, and not more than two or three months old, as, at an advanced age, the mortality is very great. Food and water must be denied them for thirty-six hours before the time of performing the operation; it having been observed that a full stomach and bowels has a tendency to promote bleeding from the wound.

Mode of performing the operation.—Secure the chicken upon its left side on a table, with its wings clasped behind its back, its legs extended backward, the upper one more so than the lower, leaving its head and

neck perfectly free, and then pluck the feathers from the right side, near the hip-joint, to the extent of an inch square. Draw the skin back, and make an incision with a bevel-edged knife between the two last ribs, commencing about an inch from the back-bone, and extending obliquely downward about an inch, or an inch and a half; cutting only deep enough to separate the ribs, without wounding the intestines. Then, having previously attached a pair of broad, blunt, silver hooks to the ends of a piece of rattan about six inches long, insert one hook in a lip of the wound, and, bending the rattan in the form of a bow, attach the second hook to the opposite margin of the wound; the spring of the bow will keep the wound open sufficiently wide to afford the operator working-room. This being done, carefully slit the skin enclosing the intestines, and if the latter are not sufficiently drawn up toward the breast-bone, push them forward with the handle of a small silver scoop, formed somewhat like a tea-spoon, but much smaller, and having a sharp steel hook at the handle end. With a delicate pair of forceps seize the skin covering the testicles, and connecting them with the back and sides, and tear it open with the sharp hook on the end of the scoop. Another instrument is then brought into requisition, consisting of a tube of some kind of metal, flattened at one end, through which passes a loop of horse-hair—the loop end extending a short distance below the flat part of the tube, and the free ends projecting some distance beyond its opposite end. With the left hand the lower, or left, testicle is raised up by means of the scoop, while the loop of horse-hair is passed over it with the right, in such manner as to encircle the parts connecting it with the back. The free ends of the horse-hair are then drawn backward and forward, while the tube is pushed toward the chicken's rump, and thus the testicle is sawed off. The same operation is then performed upon the right testicle; after which the separated testicles, together with the effused blood, are removed with the scoop, the hooks withdrawn, and the skin closed over the wound, which is then covered with the feathers plucked off at the commencement of the operation. If the side of the chicken afterwards puffs out with wind, puncture the skin and let it out. Great care must be used in performing the operation, as a careless cut may maim the chicken for life; and a failure to remove all the substance of the testicles will render the entire operation of no avail.

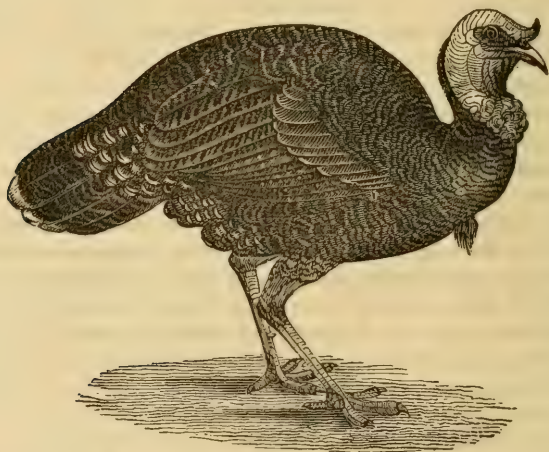
II. THE TURKEY.

VARIETIES.

The diversity of color is about all that constitutes the difference of varieties of this bird; — the black, the white, the copper-color, the brown,

the bronze, the dusky-gray, &c. As to the relative value of the ordinary varieties, there is some doubt. The bronze and copper-colored varieties

Fig. 235.



are generally small, and difficult to rear; but their flesh is very delicate. The brown and ashy-gray are not particularly remarkable, but the black are decidedly superior as regards hardiness, rearing, acquiring flesh, and the quality of the flesh; they are also very prolific.

GENERAL MANAGEMENT.

Keeping, &c. — With respect to the best mode of keeping turkeys, it is necessary to let them have a large, roomy shed, protected from the weather and from moisture. The perches should be high, and a ladder should be supplied, as the birds, when fat, are otherwise apt to injure themselves in their descent from a lofty perch. During warm weather they may be permitted to select their own roosting-places on the trees about a farm, but should be well watched, lest they stray away, and, in cold weather, get their tender toes frost-bitten.

The turkey provides itself with food from the roads and hedge-rows: snails, slugs, and worms, are among the number of its dainties, and the nearest pool serves to slake its thirst. It should, however, be kept away from the grain-fields.

Qualities. — In selecting a turkey-cock, see that he is large, stout, proud,

and majestic. Both cock and hen should have short legs, full shapes, and general vivacity and energy in all their movements, and be healthy. A turkey-cock is in his prime in his third year; the hen is in her prime younger, say in her second year.

Laying. — One fecundation, it is said by some, will render all the eggs of that laying fertile, while others allow one cock to every dozen or fourteen hens. The approach of the laying season is known by the increased liveliness and proud strut of the hen, and a peculiar self-satisfied cry. This usually takes place in March. When these symptoms are noticed, a nest should be provided, and a true or false egg put into it, to induce the hen to commence laying there, for she prefers a secret place. The time when she lays is usually the morning; some lay daily, others only every second day. When the turkeys are to be let out in the morning, examine the hens, and keep in such as are about to lay, in order to secure the eggs. While the hen is laying, the cock should be kept from her, as he would ill-treat her and break the eggs. The eggs must be taken away as soon as laid, and they will keep till the hens cease laying, if put in a basket and kept dry. The hen-turkey will hatch other eggs than her own.

Sitting. — The same barbarous stimulus, of flogging with a sprig of nettle, prescribed for hen-fowls not readily disposed to sit, has been tried for turkey-hens; and also a dose of brandy and water to make them drunk when they are placed on the eggs, to insure their sitting on their becoming sober. The dark-colored turkeys are preferable.

Any number of hens may be placed under the same shed, at short distances from each other, taking care that they are kept quiet and dark, as well as warm. The nest may be formed of a circular pad or roll, stuffed with matted straw, and about fifteen inches in diameter; the inside being filled with soft bruised straw, on which the eggs are laid, which, being secured by the border, will not roll about when the hen makes a motion to get in and out of her nest, or turn her eggs.

Hatching. — When several hens hatch at the same time, commencing together, it is obvious that if any accident should happen to one of them, the eggs may be at once transferred to some of the other nests, the evening being the proper time for this, so that on the morrow the new-comer may appear to be of her own family.

On the thirty-first or thirty-second day, the chicks, as in the case of fowls, will chip and break their shells, and get out, unless prevented by the adhesion of the body to the pellicle of the shell. When (and this direction equally applies to all poultry) a small hole is perceived in the shell, through which the bill can be seen, and the chicken appears unable to break through the shell completely, the shell should be slightly and gently broken on the

outside, and lifted up with the point of a pin, but with care not to touch the chick.

Treatment of the Young. — A few drops of wine are frequently given to reanimate drooping chicks, and some recommend bread soaked in wine for them at first; but the natural warmth of the mother's body is the best physician, and this they should as quickly as possible enjoy, as the external atmosphere is so cold compared with that in which they previously existed. The early feeding of young turkeys is very similar to that which we have recommended for fowls. Egg is a favorite food for them. They may very soon have nettles and parsley made into balls, with groats or meal boiled to the consistence of stirabout, which they learn to peck from the hand. As the mother is very stupid, and does not teach her little ones to search for food, a keeper is necessary for young turkeys, in order to feed them frequently, to take them out airing after the dew is off the ground, and place them in shelter, either from the hot sun or rain, for six weeks, when they become pretty hardy, and can eat boiled potatoes mixed with their meal. The membranes of the neck and head now *shoot the red*, as it is termed, and at this critical period poults require very high feeding. After harvest, turkey poults — which name they receive after two months — are driven in large flocks to pasture and stubble fields, where they learn to pick up insects and grains of corn; and then they are quite independent of the maternal wing, and flock with the older turkeys, and roost with and accompany them. But care should be taken to have shade or shelter always at hand for them during the sultry hours of the day, and when rain is falling.

Fattening. — After six months, turkeys may be crammed like fowls, with the same kind of food, but need not be so closely confined, though a dark place is recommended for them. It requires six weeks to render turkeys perfectly fat, and it would be barbarous to confine them in pens so long; they may be left in close farm-yards. To have very large turkeys, cocks should be kept over for fattening until they are nearly two years old; but a young hen-turkey in spring is much better in flavor.

Feeding. — In their ordinary run about the farmer's yards and fields, turkeys nearly feed themselves sufficiently; if not, they will do so by scattering among them, in the morning, oats or corn. Boiled potatoes or Swedish turnips greatly assist in the support of a flock of turkeys.

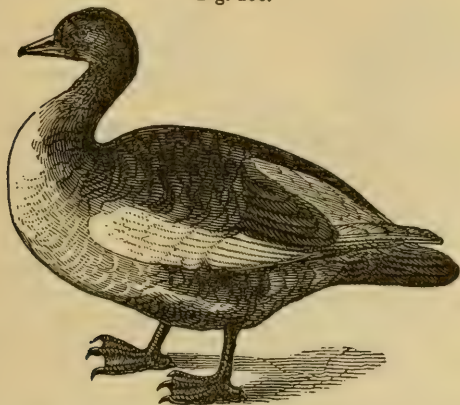
III. THE GOOSE.

VARIETIES.

TOULOUSE. — The varieties of the common domestic goose are very few. Amongst these varieties is that of the *Toulouse*, chiefly remarkable for its vast size. Its color is a slaty blue, marked with brown bars and

occasionally relieved with black — the head, neck as far as the beginning of the breast, and the back of the neck as far as the shoulders, of a dark brown; the breast is slaty blue; the belly is white, as also the under

Fig. 236.



surface of the tail; the bill is orange-red, and the feet are flesh-color. The *Toulouse* is of a mild and easy disposition, which conduces to the chance of his early fattening, and that also at little cost. The flesh is said to be tender and well-flavored.

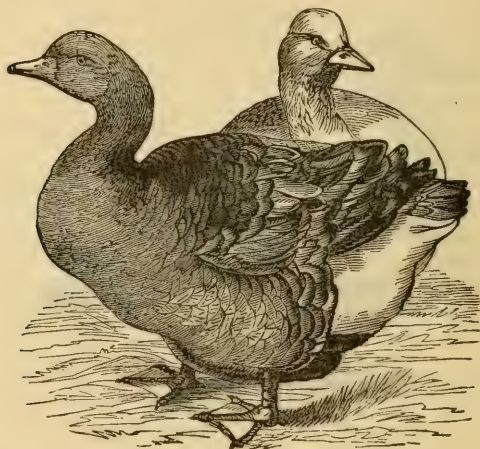
CHINESE. — The *Chinese* goose is a well-known variety, including several sub sorts, among which is the *Hong Kong*, considered the same as is called by the name of *Poland*, having a large, horny knob on the bill and forehead, the prevailing color gray, with a longitudinal stripe of deep brown running above the back of the neck, — the legs red. There are also the *Black-legged Chinese*, also knobbed, and usually with a *white edge* around the *knob*, somewhat similar to that of the wild breed called the *White Fronted*, — and the *White Chinese*, a very handsome bird, knobbed as the rest, of a snow-white color, and with legs of a bright orange-red.

These geese are inferior in size to the *Toulouse*, but, nevertheless, very fine birds, and worthy the attention of the breeder. The white variety, especially, with red legs, is very beautiful; the flesh is also good. They feed well, fatten easily, and are very prolific.

COMMON. — Of our ordinary and well-known domestic geese there exist but two sorts, whose only distinction seems to rest in their relative size, they being divided into the *large* and *small*; and by some, according to their color, into the *white* and the *gray*. These divisions are, to a certain extent,

arbitrary ; as out of the one clutch may be generally found the several varieties, both as to size and color, that are sought for. The best sorts are

Fig. 237.



those which vary least in color. *Gray* is the best ; *mixed* colors will not prove so prolific, and the young will be more difficult to feed up to the required standard.

GENERAL MANAGEMENT.

In France, geese are put up in thirties in the same lodge, with roofs and partitions to separate them, never allowing more than eight under one roof. All damp must be avoided, for geese at all times are fond of a clean, dry place to sleep in, however much they may like to swim in water. It is not a good plan, on the whole, to keep geese with other poultry ; for, when confined in the poultry-yard, they become very pugnacious, and will very much harass the hens and turkeys. It is recommended to pasture geese in marshy or moist ground, and to sow for them vetches or tares, melilot, clover, chicory, and lettuce, of which they are very fond. Grass they should also have, and they are satisfied with the poorest. In allowing geese to range at large, it must be remembered that they are very destructive to all garden and farm crops, as well as to young fruit-trees. To prevent their getting through the gaps in fences, hang a stick across their breasts.

Food. — Did geese require to be always fed in the poultry-yard, it would cost more than they are worth to keep them, for they are voracious feeders. All sorts of vegetables, food, and grain, agree with them, but they do not

thrive well without grass. The refuse of the cabbage of a market-garden would maintain a great many geese at a very small cost, but it is very doubtful whether they would keep long in good health, when fed either on cabbage, mangel-wurzel leaves, chicory, endive, lettuce, or other green food. This, indeed, is apt to render their bowels too open, and even to bring on scouring, unless alternated with boiled or steamed potatoes, given warm, or with the meal of oats, peas, beans, or maize, beaten up with boiled potatoes, carrots, or turnips.

The stubble-fields of any sort of grain are excellent pasture for geese, for there they not only find grass and other herbage, but the grain which may have been scattered, and which would otherwise be lost; while their dung, though at first acrid and apt to injure, will, when it has been mellowed, much enrich the ground.

Pairing. — It has been ascertained by M. St. Genis that geese will pair like pigeons and partridges; and, in the course of his experiments, he remarked that, if the number of the ganders exceed that of the geese by two, and even by three, including the common father, no disturbance nor disputes occur, the pairing taking place without any noise, and no doubt by mutual choice.

It is usual, in books, as well as in practice, to assign six geese to one gander. In some places, the small farmers who keep two or three geese keep no gander at all, but turn their geese, at the breeding season, for a short period, among the ganders of some larger establishment near them. This, however, must render the eggs of doubtful fertility, though, no doubt, it would not be practised, if it were found to be an unprofitable plan. The gander to be selected should be of a large size, of a fine white, with a lively eye, and an active gait; while the breeding goose ought to be brown, ash-gray, or parti-colored, and to have a broad foot. The gray geese are supposed to produce the finest goslings, while the parti-colored ones produce better feathers, and are not so apt to stray from home.

Laying. — When well kept, geese will lay thrice a year, from five to twelve eggs each time; and some more, when they are left to their own way: but if the eggs be carefully removed as soon as laid, a goose may be made, by proper feeding, to lay from twenty to fifty eggs without intermitting. They begin to lay early in spring, usually in March; and it may be known when an individual is about to lay, by her carrying straws about to form her nest with; but, sometimes, she will only throw them about. When this is observed, the geese should be watched, lest they lay in some by-place, and the eggs be lost. It is an essential precaution, as soon as it is perceived that geese want to lay, to coop them up under their roof, where nests made of straw have been previously prepared. If they can once be

induced to lay in this nest, they will continue to do so till their number of eggs is completed. In order to have early goslings, geese should be brought to lay early by keeping them in a warm, clean place, and feeding them on stimulating food.

Hatching. — When a goose, at the laying of each egg, is observed to keep in her nest longer than usual, it is a pretty sure indication that she is desirous of hatching. It is a popular but incorrect opinion, that a goose always knows her own eggs, and will not hatch any others.

The nest for hatching should be made of straw, lined with hay, and from fifteen to twenty eggs will be as many as a large goose can conveniently cover.

The goose sits for two months, and requires to have food and water placed near her, that she may not be so long absent as to allow the eggs to cool, which might cause her to abandon her task. Some put vinegar in their water, and others lift them off their nests to make them drink ; but this is not necessary.

It is an economical way of getting a great number of goslings, to employ turkey-hens to hatch. The common fowl has been equally praised for filling this important function ; but the eggs of the goose being very large, and their shell very hard, a hen is not bulky enough to hatch more than eight or nine. The turkey-hen, therefore, deserves to be preferred, because she can hatch fourteen or fifteen. This function of the goose being thus filled by another, she is not kept from laying, and yields eggs in abundance.

Goslings. — Like turkey-chickens, goslings are a month in hatching, and must be taken from under the mother, lest if, feeling the young ones under her, she might perhaps leave the rest of the tardy brood unhatched. After having separated them from her, they must be kept in flat wicker pens, or baskets, covered with a cloth, and lined with wool ; and when the whole brood is come forth, the first hatched may be returned to the mother. In some places, when the eggs of the goose are on the point of being hatched, it is customary to break the shell a little, to give air to the gosling, and to help its coming out. Perhaps this practice, though dangerous to turkey-chickens, is less so to the goose's egg, whose shell is commonly very hard. On the first day after the goslings are hatched, they may be let out, if the weather be warm, care being taken not to let them be exposed to the unshaded heat of the sun, which might kill them. The food given them is prepared with bran, raspings of bread, &c., which, if soaked and boiled in milk, or curdled milk, and lettuce-leaves, are still better.

Afterwards, advantage must be taken of a fine warm sun to turn them out for a few hours ; but cold and rain being very hurtful to them, they must in bad weather be cooped up, and prevented from mixing with the larger ones

unless they have strength enough to defend themselves against any hostile attack, to which new-comers are usually exposed. To such goslings as are a little strong, bran may be given twice a day, morning and evening, continuing to give them this food until the wings begin to cross on the back; and after this, green food, which they are particularly fond of, may be mixed with it, such as lettuce, beet-leaves, and the like.

Fattening. — Like other fowls, geese may be brought, by proper management, to a great degree of fatness; but the period at which they are the fattest must be chosen to kill them, otherwise they will rapidly become lean again, and many of them would die. Geese may be fattened at two different periods of their life, — in the young state, when they are termed green geese, and after they have attained their full growth. The methods at each period are very nearly the same.

For fattening geese, — boiled oats, given thrice a day, with plenty of milk, will, it is said, fatten them well in a month. For stubble geese, besides oats, give split beans, with meal and water, cooping up in a quiet, dark place, as is done with fowls. The London feeders, when they receive goslings in March, begin feeding them on meal, from the best barley and oats, made into a liquid paste. They are afterwards fed on dry corn, to render their fat firmer. Full-grown geese are kept particularly clean, have regular exercise, and are fed with proportional quantities of dry, soft, and green food. Cabbage and lettuce alone will fatten young geese, bought in the end of June. Some persons recommend steamed potatoes, with a gallon of buckwheat or ground oats to the bushel, mashed up with the potatoes, and given warm. This, it is said, will render geese, cooped in a dark, quiet, cool place, fat enough in three weeks. The French mode of fattening consists in plucking the feathers from under the belly, giving them abundance of food and drink, and cooping them up more closely than is practised with common fowls, cleanliness and quiet being above all indispensable. The best time is in the month of November, or when the cold weather begins to set in; if it is longer delayed, the pairing season approaches, and prevents their becoming fat. When there are not many geese to fatten, they are put into a cask having holes bored in it, through which they may thrust their heads to feed; and being naturally voracious, the love of food is greater than the love of liberty, and they fatten readily. The food consists of a paste, made of barley-meal, ground maize, and buckwheat, with milk and boiled potatoes. In Poland, a similar method is practised, the goose being put in an earthen pot without a bottom, and of a size not to allow the bird to move. The same food as that just mentioned is given in abundance, and the pot is so placed that the dung may not remain in it. The process is completed in a fort-

night, and the geese are sometimes so increased in size that the pot has to be broken to get them out.

When the great number of geese to be fattened renders the preceding plan inconvenient and too expensive, they are taken from the stubbles or pasture, and cooped up, twelve together, in narrow pens, so low that they can neither stand upright nor move in any direction. They are kept scrupulously clean, by often renewing the litter of the pens. A few feathers are previously plucked out from the rump, and from under the wings. The portion of maize required for once feeding is boiled and put into a feeding-trough, with clean water, in a separate vessel, and they are permitted to eat whenever they feel inclined. At the commencement they eat a great deal constantly, but in about three weeks their appetite falls off. As soon as this is perceived, they are crammed, at first twice a day, and, towards the end of the process, thrice a day. For this purpose a tin funnel is used, with a pipe five inches and a half in length, and less than an inch in diameter, with the end sloped off like the mouth-piece of a flageolet, and rounded at the edge, to prevent its scratching the throat when it is introduced. A small, round bag is adjusted to the pipe, through which grain is introduced into the crop. The operator sits squat upon the ground, holds the goose with one hand, introduces the pipe of the funnel into the mouth of the goose with the other, and presses in the food till the crop is filled. Water is at the same time given to the geese to drink, and must always be left near them, as the cramming renders them very thirsty. A woman who is dexterous will cram ten geese in an hour. In less than a month, a goose may in this way be fattened to an enormous bulk.

Sometimes a lean goose is confined in a small coop made of fir, narrow enough to prevent it from turning, while there is a place behind for passing the dung, and another in front to let out the head. Water is supplied in a trough in front, having some bits of charcoal in it to sweeten it. A bushel of maize is considered enough of food for a month. It is soaked in water the day before it is used; and the goose is crammed morning and evening, while it is allowed, during the day, to eat and drink as much as it chooses. About the twenty-second day, a quantity of poppy-oil is mixed with the maize. In a month, it is seized with difficulty of breathing, and a lump of fat under each wing indicates that it is time to kill it, lest it should be choked with fat, and die.

By this process, the liver of the goose is increased so much that it will weigh from one to two pounds, and will, besides, yield about three pounds of fat, much employed, in French cookery, for dressing vegetables.

IV. THE DUCK.

VARIETIES.

ROUEN, OR RHONE. — There are numerous species and varieties of the duck, of great diversity of size and color, though it is not usual to domesticate, except for curiosity, more than two or three of these. The tame variety most in request is the dark-colored *Rouen* or *Rhone* duck, originally from France,

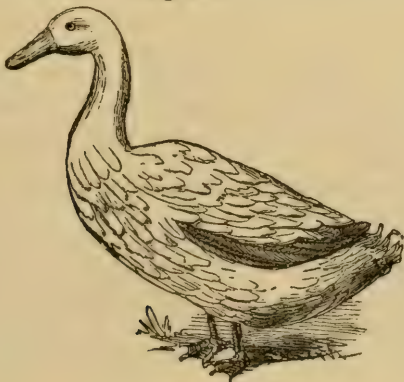
Fig. 238.



but now sufficiently common. These ought to be of the largest size, for, if they are small, it is probable they are not far removed from the original wild breed, and in that case will not only be very apt to stray away, but will be less prolific in eggs, though both the eggs and the flesh will be higher flavored

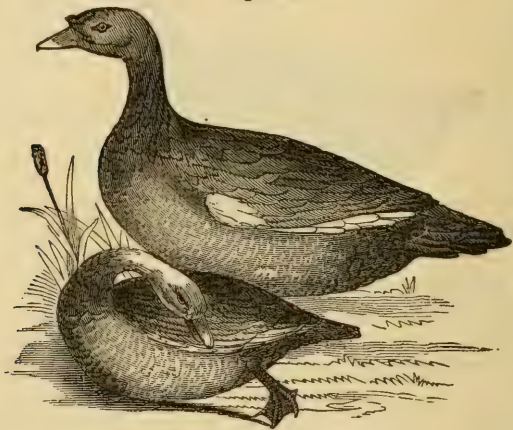
ENGLISH, OR AYLESBURY WHITE. — This variety, though handsome and strong, is inferior in flavor, the flesh being too light-colored, and *chickeny*, as it is termed. Great numbers of this variety are, however, raised and fattened, attaining to a large size.

Fig. 239.



MUSCOVY. — This duck is a distinct species, and not a mere variety, much larger than the common duck, and distinguished by a sort of red membrane, covering the cheeks, and extending behind the eyes, as well as by the musky odor exhaled by the rump gland. In a wild state, the drake is of a brownish-black color, with a broad white patch on the wings, the female being smaller and more obscurely colored. In the domestic state it exhibits every variety of color, like the common duck. The Muscovy duck is easily fattened, and a prolific breeder ; and hence, though it is also a voracious feeder,

Fig. 240.



it may be rendered profitable to rear. The male is very ready to pair with the common duck, producing, by the cross, a hybrid or mongrel breed.

GENERAL MANAGEMENT.

The Duck Pond. — In order to keep ducks properly, a pond should be provided for them, if there be no water convenient ; and it is important, if the pond will admit of it, to have a small island in it, planted with rushes, osiers, and other aquatic plants and shrubs, though some recommend to have no plants in the way.

Food. — Ducks may be left to provide for themselves a considerable part of the year. They live chiefly on grain strewed about the poultry-yard, the siftings and sweepings of barns, all sorts of mealy substances, the residue of breweries and boiling-houses, herbage, vegetable roots, fruits, — everything, indeed, suits them, provided it be rather moist. They are particularly fond of boiled potatoes, and these have been substituted, with profit, for maize and barley. They are partial to being in meadows and pasture

grounds Every sort of flesh or offal is much to their liking, and forwards their growth admirably. Ducks are so very greedy that they often endeavor to swallow a whole fish, or a frog, which heats them extremely, if they do not immediately throw it up. Particularly fond of meat, they eat it with avidity, even when it is tainted. Slugs, spiders, toads, garbage, insects, all suit their ravenous appetite. Among all the fowls of the poultry-yard, ducks are of most service in gardens, by destroying a quantity of vermin, which usually do irreparable damage; but their voracity brings with it inconveniences which balance this advantage, except in the case of ducklings, which are not so apt to eat young plants.

Pairing and Laying. — One drake is said to be sufficient for eight to ten ducks, while others limit the number to from four to six. In a wild state there is only one duck to a drake, and, therefore, we should say, the fewer the better, — the chief difference of the tame duck from the wild arising from more abundant and regular food.

Ducks begin to lay towards the end of February, and sometimes earlier; but so far from laying the limited number of about sixteen eggs, some will lay as many as fifty, and even nearly double that number. They do not, however, usually continue to lay later than the month of May, unless they be very well fed, — the great secret of rendering them prolific, provided they do not become too fat.

At the laying season, ducks require to be looked after, inasmuch as they are not so easily brought to lay in the nests prepared for them as common fowls, but will stray away to hedges and other by-places to lay, and will even sometimes drop their eggs in the water. When they succeed in laying out their number of eggs without their nest being discovered, they will hatch them, and not make their appearance till they bring their young family home to the yard, except in cold, raw weather. As ducks usually lay either at night or very early in the morning, it is a good way to secure their eggs, to confine them during the period when they must lay, — a circumstance easily ascertained by feeling the vent. It will accordingly be requisite, at the approach of the laying season, in spring, to give them food in a particular place, three or four times a day, to prevent them from wandering; and when once they can be got to lay in a nest prepared for them, they will probably continue to do so, without laying away.

Duck Eggs. — The eggs of the duck are readily known from those of the common fowl by their bluish color and larger size, the shell being smoother, not so thick, and with much fewer pores. When boiled, the white is never curdy, like that of a new-laid hen's egg, but transparent and glassy, while the yolk is much darker in color. The flavor is by no means so delicate. For omelets, however, as well as for puddings and pastry, duck eggs are much

better than hen's eggs, giving a finer color and flavor, and requiring less butter.

Hatching and Care of Ducklings.—The domestic duck is not naturally disposed to hatch; but in order to induce it to do so, towards the end of laying, two or three other eggs may be left in each nest, taking care every morning to take away the oldest laid, that they may not be spoiled. From eight eggs to ten may be given, according to the size of the duck and her ability to cover them, taking particular care not to sprinkle them with cold water, as some authors wrongly advise. The duck requires some care when she sits; for, as she cannot go to her food, attention must be paid to place it before her—and she will be content with it, whatever be its quality. It has even been remarked, that when ducks are too well fed, they will not sit well.

The first broods of the season are usually the best, because the heat of summer helps much to strengthen the ducklings,—the cold always preventing the later broods from getting strong.

The duck is apt to let her eggs get cold, when she hatches. The ducklings are no sooner excluded than the mother takes them to the water, where they dabble and eat at the very first, and many of them perish, if the weather is cold.

All these reasons often induce poultry-keepers to have duck's eggs hatched by hens or turkey-hens; and, being more assiduous than ducks, these borrowed mothers take an affection for the young, to watch over which requires great attention, because, as these are unable to accompany them on the water,—for which they show the greatest propensity as soon as they are excluded,—they follow the mother hen on dry land, and get a little hardy, before they are allowed to take to the water without any guide.

It is likely that, if a considerable quantity of eggs could be collected together, to make one large brood, the art of hatching chickens in an artificial manner, applied to ducks, would be attended with greater success than with chickens, as they are less difficult to rear. It would be sufficient to keep them shut up for twelve days in a duck-house made on purpose, and where it would be proper to leave a few buckets of water for them to dabble in,—or a tank might be provided for them, the water of which might be kept slightly warm by the pipes used to heat the buildings of the poultry-yard. At the expiration of this time they might be set at liberty, and they would get on surprisingly, provided they had a pond or a little ditch in the enclosure, where they might be turned in, or a small rivulet running through it. Ducklings can do without a mother as soon as they are excluded. Their food, for the first days, may be crumbled bread sopped in milk, and a little ale or cider. Some days after, a paste may be made for them with a bunch

of nett.e-leaves, boiled tender, chopped up very small, and of a third of the flour of maize, buckwheat, or barley.

As soon as they have a little strength, a good deal of pot-herbs may be given them, raw and chopped up, mixed with a little bran soaked in water, barley, mashed acorns, boiled potatoes, beaten up with a little fish, when it can be had. All these equally agree with ducklings, which devour the different substances they meet with, and show, from their most tender age, a voracity which they always retain. To strengthen the young ones before they take to the water, they must be secured under coops during eight or ten days, and taking care to put a little water under the coops.

When ducklings have been hatched under a common hen, or a turkey-hen, they are not allowed to go to the water till they become a little hardy by remaining on land; but the moment they see water, they naturally plunge into it, to the great alarm of their foster-mother, who cannot follow them. It is necessary, to prevent accidents, to take care that such ducklings come regularly home every evening; but precautions must be taken before the ducklings are permitted to mingle with the old ducks, lest the latter ill-treat and kill them, though ducks are by no means so pugnacious and jealous of new-comers as common fowls uniformly are.

Fattening. — Butchers' offal is excellent for fattening ducks, as it does not give the flesh the rank, disagreeable flavor, which it imparts to pork. Acorns, on the contrary, while they are good for fattening, injure the flavor of the flesh, and barley renders it insipid, or woolly.

As the duck is both a voracious feeder and fond of liberty, it will fatten very well when allowed to roam about, provided it has abundance of food; but it expedites the process of fattening to have recourse to coops, quiet, and darkness. Ground malt, mixed with water, is said to be an excellent food for fattening, though it is expensive. In Lower Normandy, where great numbers of ducks are reared and fattened, the poulterer prepares a paste with the flour of buckwheat, made into gobbets, with which they are crammed thrice a day, for eight or ten days, when, though not full fat, they are sufficiently so for use. In some places, when ducks have been rendered tolerably fat by being at large, they are cooped up by eights or tens, in a dark place, whence they are taken out morning and evening to be crammed. This is done by a girl, who crosses their wings on her knees, opens their bill with her left hand, while with her right she stuffs them with boiled maize. Many ducks are suffocated by the operation, and killed outright; but their flesh is not the worse for the table, provided that they be immediately bled. It requires a fortnight to complete the process, which increases the size of their liver enormously, and oppresses their breathing in

a distressing manner. The sign of their being sufficiently fat is, when the tail opens like a fan, from the fat pressing on the roots of the feathers.

DISEASES OF THE FOREGOING FOWLS.

The most common diseases to which fowl are liable are, Molting, Pip, Roup, Asthma, Diarrhœa, Indigestion, Apoplexy, Fever, Consumption, Gout, Corns, Bloody-flux, Costiveness. They are also liable to accidents, producing Fractures, Bruises, Ulcers, Loss of Feathers, &c. All these we will treat of in the above order.

Molting. — While, as being a natural process, of annual occurrence, it can scarcely be called a disease, yet it must be treated of as if it really were one, from consideration of the effects which it produces. It is most dangerous to young chickens. With adult birds, warmth and shelter are usually all that are required, united with diet of a somewhat extra stimulating and nutritious character.

In a state of nature, molting occurs to wild birds precisely when their food is most plenty; hence, nature herself points out that the fowl should, during that period, be furnished with an extra quantity of food. After the third year, the period of molting becomes later and later, until it will sometimes happen in January or February. Of course, when this occurs, every care as to *warmth* should be bestowed. The use of Cayenne pepper alone will generally suffice; and if this simple treatment does not help them through, they can seldom be saved.

The feathers will at times drop off the fowls, when not molting, to a very considerable extent, rendering them often nearly naked. This is a disorder similar to the mange in many other animals; and the same sort of treatment, viz., alteratives, such as sulphur and nitre, — in the proportions of one quarter each, mixed with fresh butter, — a change of diet, cleanliness, and fresh air, will generally be found sufficient to effect a cure. Be careful not to confound this affection with molting. The distinction is, that in the latter case the feathers are replaced by new ones as fast as they are cast; in the former this is not so, and the animal becomes bald.

Pip. — A disease to which young fowls are peculiarly liable, and that, too, chiefly in hot weather. The symptoms are, a thickening of the membrane of the tongue, especially towards the tip. This speedily becomes an obstruction of sufficient magnitude to impede the breathing; this produces gasping for breath, and at this stage the beak will often be held open. The plumage becomes ruffled and neglected, especially about the head and neck. The appetite gradually goes, and the poor bird shows its distress by pining, moping, and seeking solitude and darkness.

The cause of this disease is want of clean water, and feeding upon *hot*

food. To cure it, most writers recommend the immediate removal of the thickened membrane. It is better, however, to anoint the part with fresh butter or cream. Prick the scab with a needle, if you like, and give internally a pill, about the size of a marble, composed of equal parts of scraped garlic and horse-radish, with as much Cayenne pepper as will outweigh a grain of wheat. Mix with fresh butter, and give it every morning, keeping the fowl warm. Keep the bird supplied with plenty of fresh water; preserve it from molestation by keeping it by itself, and it will generally get well, if the disease is attended to in time. Do not cram the mouth with snuff; when, however, the disease depends on the presence of a worm, forcing tobacco-smoke down the bird's throat is beneficial.

Roup.—The disease to which this term is improperly applied is an inflammation of the tail gland. The true Roup is much analogous to influenza in man, and even more so to the well-known distemper among dogs. The symptoms are, a difficulty of breathing, constant gaping, dimness of sight, lividity of the eyelids, a discharge from the nostrils that gradually becomes purulent and fetid, loss of appetite, and extreme thirst. Sometimes this disease appears to occur independently of any obvious cause; but dirt, too hot feeding, and want of exercise, are amongst the most usual.

As to treatment, we will record a case related by an intelligent farmer. A cock, of about four or five months old, apparently turned out by somebody to die, came astray, and was in the last stage of roup. The discharge from his mouth and nostrils was very considerable, and extremely pungent and fetid, while his eyes appeared to be affected with an inflammation similar to Egyptian ophthalmia. The cock was placed at the fireside, his mouth and nostrils washed with soap and warm water, his eyes washed with warm milk and water, and the head gently rubbed with a dry cloth. Internally he was given long pellets, formed of barley meal and flour equal parts, mustard and grated ginger equal parts, and half the first-named. He was also given to drink lukewarm water, sweetened with treacle. In three days this bird began to see, and in a week his sight was almost wholly restored. A little mustard was still given him in his water, and then some flour of sulphur. He had also a pinch of calomel in some dough. He was gradually brought out, so as to inure him to the cold, and in a month was as well as ever. Having molted late, the same bird caught cold at the first frost, and suffered a relapse, from which, however, he was recovered by warmth alone.

Other poultry-keepers recommend a modification of the above, — warmth and cleanliness, as matters of course; — but, for pellets, — powdered gentian 1 part, do. ginger 1 part, Epsom salts $1\frac{1}{2}$ part, flour of sulphur $\frac{1}{2}$ part, — made up with butter, and given every morning.

If the discharge should become fetid, the mouth, nostrils, and eyes, may be bathed with a weak solution, composed of equal parts of chloride of lime and acetate of lead. Fomentation with an infusion of camomile flowers is highly beneficial.

The other affection, that improperly passes under this name, viz., swelling of the tail-gland, may be treated as a *boil*. If it become inconveniently hard and *ripe*, let the *pus* or *matter* out with a penknife, and it will soon get well.

Asthma. — This is characterized by gaping, panting, and difficulty of breathing. We need not go far to seek for a cause. Our poultry are originally natives of tropical climates; and, however well climatized they may appear, they nevertheless require a more equable temperature than our climate, unaided by artificial means, can afford. Hence, coughs, colds, catarrh, asthma, pulmonary consumption. To remedy it, give warmth, with small repeated doses of hippo-powder and sulphur, mixed with butter, and add Cayenne pepper.

Diarrhæa is occasioned by damp, and sometimes by improper food. Remove the bird into dry quarters; change the food; if it become very severe, give chalk; add a little starch, mixed with Cayenne, to porridge, and give it warm.

Indigestion. — Caused by over-feeding, and want of exercise. Remedy by lessening the quantity of food; turn the fowl into an open walk, and give some powdered gentian and Cayenne in the food.

Apoplexy. — Symptoms — staggering, shaking of the head, and a sort of tipsy aspect. Some persons have, from ignorance of the true cause of this affection, treated it as proceeding from intestinal irritation, and prescribed castor-oil, with syrup of ginger, &c. Scanty food, and that of light quality, and the application of leeches to the back of the neck, constitute an effectual remedy, — the *knife*, however, is the truest one.

Fever. — Fowls are frequently subject to febrile affections. The mode of treatment is simple — light food and little of it, change of air, and, if necessary, aperient medicines, such as castor-oil, with a little burnt butter.

Consumption. — If not incurable, change of air and warmth is about the only means of doing any good.

Gout. — Its effects are obvious. Pellets of colocynth *may* be used; but, if the fowl had been killed before becoming so old, it would have been better. Sulphur may be found useful.

Corns. — These may generally be extracted with the point of a pen-knife. If ulcerated, as will often occur when neglected, touch with lunar-caustic and you may thus succeed in establishing healthy granulations.

Bloody-flux generally proceeds from an aggravated diarrhœa. Rice boiled in milk, or starch, usually effects a cure.

Costiveness. — This affection will, in general, yield to castor-oil and burned butter. The diet should be sparing. Thin porridge will be found useful.

Fractures and Bruises. — In the case of fractures, the best way, in most cases, is to put the fowl to death, without loss of time. The same may be said of bruises.

Ulcers. — These may be kept clean, dressed with a little lard, or washed with a weak solution of sugar of lead, as their aspect may seem to indicate. If they appear sluggish, they may be touched with bluestone.

Loss of Feathers. — The accidental stripping of the feathers must not be confounded with the mangy affection already treated of. The difference will be seen by examining the state of the skin where it is exposed.

Peacocks and Guinea Hens. — Although now comparatively common, these two birds are more raised for their appearance than for mere profit. The Peacock has always been admired for its magnificent plumage. Its flesh is dark colored and coarse grained. The flesh of the Guinea Hen though dark, is tender and of a fine flavor. As the both of these birds are difficult to rear, they can never become popular barnyard favorites.

CHAPTER IX.

BEEES AND SILKWORMS.

DIFFERENT CLASSES OF BEES—POSITION OF THE APIARY—HIVES AND BOXES
—OBTAINING STOCK—SWARMING—THE HONEY HARVEST—MANAGEMENT
DURING WINTER AND EARLY SPRING—HOW TO TREAT THE PRODUCE OF THE
HONEY HARVEST—THE DISEASES AND ENEMIES OF BEES—SILKWORMS.

I. DIFFERENT CLASSES OF BEES.

The Queen.—The number of bees contained in a hive will, of course, vary with their condition, and the accommodations they possess; whatever, however, be their numbers, their occupations are alike, and are similarly distributed amongst the three classes composing the inmates of the hive. These classes are, first, the Queen-bee, the sovereign of the community, and literally the prolific parent of her subjects. The queen-bee reigns alone; but one of her sex is permitted to exist in a hive at the one time, and to her protection and comfort are the energies of the other bees to be directed. The queen-bee may be recognized by her greater length of body, which is

Fig. 241.



of a blackish color above, and of a yellowish tint beneath. She is usually, but not by any means invariably, of a larger size than either of the other classes; her abdomen contains two ovaries, or receptacles for eggs; and her sting is of a curved form. The queen-bee commences depositing her eggs when five days old; during the heat of the season she lays from one hundred and fifty to two hundred eggs per day, and lays with little or no intermission from early spring to the middle of autumn.

The Drone. — The second class of bees are the drones. These are larger in the body than either the queen or the working-bee. Their head is rounder, proboscis shorter, eyes fuller, and *no sting*. They also make more noise in flying than the other bees. The drones are the males of the hive; by

Fig. 242.



them the queen is impregnated and her eggs fertilized, though this latter may be said to be a point not yet definitely settled by those who have investigated the subject.

During the summer the drones remain dispersed through different parts of the hive, in a state of idleness; but towards its close they assemble together in companies, as if preparing for their impending fate, which they await in patience, or rather, perhaps, in motionless lethargy. At the end of summer, in August or the end of July, they are ignominiously expelled from the hive, and even slain, by the workers, as if they, being no longer of any utility to the community, should not be fed from the store during winter.

The Working-bee. — The third class is the working-bee, the most interesting of all. It is considerably less than either the queen-bee or the drone; it is about half an inch in length, of a blackish-brown color, covered with closely-set hairs all over the body, which aid it in carrying the farina it gathers from the flowers; and on the *fore-arm*, as it were, of the hind legs,

Fig. 243.



is a cavity, of cup-like form, for the reception of the little kneaded ball of pollen. It is the working-bee which collects honey and pollen, and which forms the cells, cleans out the hive, protects the queen, looks after the condition of the young brood, destroys or expels the drones, when those are no longer necessary to the well-being of the community; who, in short, performs

all offices connected with the hive and its contents, save only those which have reference to the reproduction of the species. The working-bees are of no sex, and are furnished with a horny and hollow sting, through which poison is ejected into the wound it makes. This poison is of an acrid character, and of great power in its effects, proving fatal to insects, and instances are on record of its proving so to horses and cattle, and even to human beings. When human beings, however, are stung, they can instantaneously obtain relief by pressing upon the point stung with the tube of a key; this will extract the sting, and relieve the pain, and spirits of harts-horn will at once remove it.

Structure of the Bee. — It is composed, like insects generally, of three parts — the head, thorax or chest, and abdomen. The shape of the head varies somewhat, as also does its size, in the three classes; it is attached to the thorax by a thin ligament, and the thorax is attached in a similar manner to the abdomen. In front of the head are two eyes, which are protected by hairs from any substances that might otherwise injure them, and on the top of the head are three smaller eyes. This visual apparatus renders the bee's power of sight a very extended one. Two feelers spring from between the front eyes, and curve outwards on each side; these are endowed with a very acute sense of touch, and doubtless perform many of the offices of eyes in the dark recesses of the hive. It is probably by the assistance of these delicate and highly sensitive organs that these insects form their combs, fill their cells, and feed the young. The mouth of the bee is composed of a pair of jaws, which open vertically, and act — opening and shutting — to the right and left. These are furnished with teeth at their extremities. The mouth is also furnished with a very minute tongue, and with a long, slender instrument, called a proboscis, or trunk, resembling in form and use that of the elephant; it is composed of numerous cartilaginous rings, fringed with minute hairs. This instrument does not, however, act as a tube, but by rolling about and attaching to the hairs which fringe it whatever substances the insect wishes to convey to the mouth. From about the base of the proboscis also arise the labial feelers, as they are called, which are also furnished with a hairy fringe.

The bee has three pairs of legs, of which the posterior are the longest, and the anterior the shortest. These are formed and articulated much like the same limbs in man, and are attached to the thorax; at their extremities we find two little hooks, which appear like sickles, or reaping-hooks, and have their points opposed to each other. By means of these the insect suspends itself to the top of the hive, or in any other position it may desire.

To the superior portion of the thorax are attached four wings, consisting of two pair, of unequal size. These wings are hooked together, in order

that they may act simultaneously, and not only serve to convey the insects from place to place, through the air, but, by the humming, buzzing noise their motion produces, to give notice of their departure from, and return to, the hive, as well as possibly to animate their fellows in their mutual labors.

Interiorly the thorax contains the œsophagus, or gullet, which traverses its extent on its way into the abdomen, where it dilates into, first, the honey-bag, which is furnished with two pouches posteriorly, and a muscular apparatus, by which it is enabled to give forth its saccharine contents; and, secondly, into the true stomach, in which digestion goes on, for the nourishment of the insect, and the secretion of wax. Next to the stomach is situated the sting; this consists of two darts in a sheath. The whole appa-

Fig. 244.



ratus enters the wound, and the two small darts then enter still further; these are barbed, and, on the insect withdrawing them, aid in widening the puncture, and thus afford greater room for the introduction of the poison. At the base of the sting the bag containing the poison is placed.

The bee respire by means of *spiracles*, or breathing-holes, situated in the thorax, beneath and behind the wings. Through these air is admitted into the thorax, for the purpose of oxygenating the circulating system,—a fact which proves the necessity for duly ventilating the hives or bee-boxes.

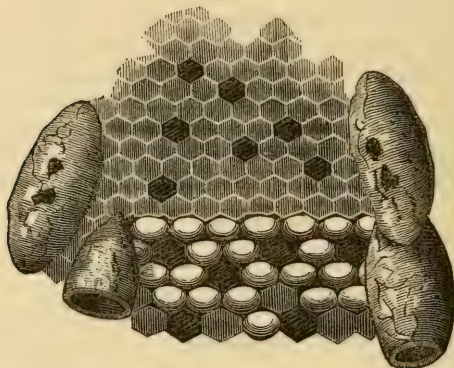
II. POSITION OF THE APIARY.

The details of the domestic operations of the bee in the cells,—a figure of which is seen in Fig. 245,—we do not intend to present in this place, but proceed to speak of those matters more particularly pertaining to the plan of management pursued by the bee-keeper or farmer.

Aspect.—The most favorable aspect for the hives or boxes is south-westerly, which, however, may advantageously be modified or varied according to the season. In spring, for instance, the aspect would be more improved by inclining more to the west; in autumn, the reverse. The reason for this is, that the *morning* sun is prejudicial to the interests of the hive,—the bees receiving the light and going forth too early,—a thing objectionable on two accounts; first, that, especially in early spring, the dawn is *too cold*, and will occasion the death of numbers, if they are induced

to venture forth ; and, secondly, because the bees, if they commence operations so early, become wearied before they have performed a good day's work, and the afternoon is a more advantageous period for their labors.

Fig. 245.



Location. — The place for fixing the stand should be a dry soil, — and a sandy one is better. It should slope towards the front, in order to carry off the surface water produced by occasional rains, and should not, on *any account*, be exposed to the droppings from the eaves of houses, or even hedges. Shelter is essential, especially behind and on the east of the hives, — a house or high wall is the best ; it is also recommended that the stand be placed in a sort of small, open shed, well painted on the outside, to protect it from the weather ; a few shrubs about the stand are also good as additional shelter. Some recommend high trees for the purpose of keeping the air calm, lest the bees should be blown down, when returning home. *High trees* are *not* advisable. Bees are seldom blown to the ground by mere wind, but even when they are, they can, in a great majority of cases, recover themselves ; whereas, if blown amongst trees, they will be sure to be whipped so violently by the branches, that they are absolutely hurled to the ground with such force as to render their recovery hopeless. The bees also fly *low*, on their return, when they arrive at the immediate neighborhood of their stand, and, consequently, high trees would be not only useless, but inconvenient. Whatever trees, therefore, are planted in the immediate vicinity of the hive, should be of low size, with bushy heads, in order that the swarms which settle on them may be more easily hived.

Avoid a site near mills or other noisy places, or the neighborhood of offensive odor, as factories and the like ; and if, as occasionally may happen

the stand be placed against the garden wall, behind which is the farm-yard, let not a dung-hill be built against the opposite side, as it may cause a desertion of the boxes. Do not place the stand where there are rat or mouse holes.

Water is essential to the well-being of bees; it must, however, be presented to them judiciously, or it will prove a greater evil than a good. If there is a shallow, rippling brook through the garden, so much the better; if not, place near the stand small, shallow pans of water, and put some pebbles in them. This water should be changed daily. It is objectionable to have a pond or canal in the neighborhood; thousands of bees will be lost every season through such a means, as they will be constantly blown into them when returning heavily laden to the hive, especially in the evening, when wearied, after the toil of an industriously-spent day. The pebbles in the troughs are for the bees to rest on while drinking.

It is well if the garden is abundantly planted with such shrubs and flowers as afford honey, in order to prevent, as much as possible, the necessity of the bees constantly traveling to an inconvenient distance in search of food. It is well also to so contrive as to have a *succession* of such food, adapted to the season,—a matter comparatively easily managed, and of some consequence to the well-being of the bees. Among these plants may be enumerated broom, furz or gorse, thyme, especially lemon-thyme, clover, crocus, heaths, fruit-trees, mustard, mignonette, sage, single roses, radishes, primroses, parsley, peas, parsnips, marigolds, violets, lilies, laurustin, daffodils, celery, cauliflowers, asparagus, sunflowers, wall-flowers, borage, winter vetches, buckwheat.

Hives should on no account be so placed as to be exposed to the noonday sun; this will injure the honey and melt it, and will raise the temperature of the hive so as to produce unwished-for swarming, besides otherwise annoying and injuring the bees. A few shrubs, therefore, should be so placed as to cast their shadow across the stand during the heat of day. Let the shrubs be of such a description as the bees are fond of, and they may also be disposed so as to give the apiary a pleasing and picturesque appearance.

Bee-houses are only fit for keeping the bee-boxes in during winter;—one, two, or three sets of collateral boxes, are as many as any moderate bee-keeper will desire, or be able conveniently to attend, and these can be kept each in a little shed by itself. Bee-hives should never be placed *close* to each other, as they must necessarily be in the bee-houses recommended by some, for bees are naturally very irritable and pugnacious insects, and if two colonies be kept too near each other, battles will ensue, and the weaker hive be injured or destroyed.

III. HIVES AND BOXES.

Requisites. — The old straw, conical-shaped hive, is too well known to need description, and, perhaps, too unprofitable to be worthy of it. The chief objects to be effected by the use of a suitable receptacle for bees are, first, the power of depriving them of their honey at pleasure, and without injury to them; secondly, the obtaining of it in its pure and uncontaminated form; thirdly, the means of enlarging their accommodation when necessary, and the consequent prevention of swarming.

Different Kinds of Hives and Boxes. — Among other hives of considerable merit, that called the *Nutt* hive is worthy of being noticed and explained, and the opinions of Mr. Nutt, the inventor, are of sufficient value to be presented in this place. According to Mr. Nutt, bee-boxes should be from eleven to twelve inches square inside, and nine or ten inches deep in the clear. The best wood for them is by some said to be red cedar, — the chief grounds of preference of which wood are, its keeping away moths, and its being a bad conductor of heat. But of whatever kind of wood bee-boxes are made, it should be well seasoned, perfectly sound, and free from what carpenters term *shakes*. Good, sound red deal answers the purpose very well. The sides of the boxes, particularly the front, should be, at the least, an inch and a half thick; for the ends, top, and back part, good deal, one inch thick, is sufficiently substantial; the ends that form the interior divisions and openings must be of half-inch stuff, well-dressed off, so that when the boxes and the dividing tins are closed, — that is, when they are all placed together, — the two adjoining ends should not exceed five eighths of an inch in thickness. These communication ends — the bars of which should be exactly parallel with each other — form a communication or division, as the case may require, which is very important to the bee, and by which the said boxes can be immediately divided, without injuring any part of the combs, or deluging the bees with the liquid honey, which so frequently annoys them, in extracting their sweets from the piled or storified boxes. The receptacles or frame-work for the ventilators, which appear upon each side of the end boxes, — the one with the cover off, the other with it on, — must be four inches square, with a perforated flat tin, of nearly the same size; and in the middle of that tin must be a round hole, to correspond with the hole through the top of the box, in the centre of the frame-work just mentioned, an inch in diameter, to admit the perforated cylinder tin ventilator, nine inches long. This flat tin must have a smooth piece of wood, well made, to fit it closely, and to cover the frame-work, so as to carry off the wet; then placing this cover over the square perforated tin, the box will be secure from the action of wind and

rain. The perforated cylinder serves both for a ventilator and also for a secure and convenient receptacle for a thermometer, at any time when it is necessary to ascertain the temperature of the box into which the cylinder is inserted. Within this frame-work, — and so that the perforated flat tin, already described, may completely cover them, — at each corner, make a hole with a three-eighths' centre-bit, through the top of the box. These four small holes materially assist the ventilation, and are, in fact, an essential part of it.

We next come to the long floor, on which the three square bee-boxes which constitute *a set* stand collaterally. This floor is the strong top of a long, shallow box, made for the express purpose of supporting the three bee-boxes, and must, of course, be superficially of such dimensions as those boxes, when placed collaterally, require; or, if the bee-boxes project the eighth part of an inch over the ends and back of this floor-box, so much the better; because, in that case, the rain or wet that may at any time fall upon them will drain off completely. For ornament, as much as for use, this floor is made to project about two inches in front; but this projection must be sloped, or made an inclined plane, so as to carry off the wet from the front of the boxes. To the centre of this projecting front, and on a plane with the edge of the part cut away for the entrance of the bees into the pavilion, is attached the alighting board, which consists of a piece of planed board, six inches by three, having the two outward corners rounded off a little. The passage from this alighting board into the pavilion (not seen in the plate, it being in the centre of the side not shown) is cut, not out of the edge of the box, but out of the floor-board, and should be not less than four inches in length and about half an inch in depth, or so as to make a clear half-inch way under the edge of the box for the bee passage. This is preferable to a cut in the edge of the box, because, being upon an inclined plane, if at any time the wet should be driven into the pavilion by a stormy wind, it would soon drain out, and the floor become dry; whereas, if the entrance-passage be cut out of the box, the rain, that may and at times will be drifted in, will be kept in, and the floor be wet for days, and perhaps for weeks, and be very detrimental to the bees. In depth, the floor-box, measured from outside to outside, should be four inches, so that if made of three-fourths'-inch deal, there may be left for the depth of the box part two inches and a half. Internally it is divided into three equal compartments, being one for each bee-box. Admission to these compartments, or under-boxes, is by the drawer, or drawer-fronts, or blocks, which will be described presently.

The bottom, or open edge, of each of the boxes, should be well planed, and made so even and square that they will sit closely and firmly upon the afore-said floor, and be as air-tight as a good workman can make them. In the

floor-board are made three openings, one near the back of each box. These openings are of semilunar shape (though any other shape would do as well), the straight side of which should not exceed three inches in length, and will be most convenient if made parallel with the back edge of the box, and about an inch from it. They are covered by perforated or by close tin slides, as the circumstances of the apiary may require. The drawer, the front of which appears under the middle box, is of great importance, because it affords one of the greatest accommodations to the bees in the boxes. In this drawer is placed, if necessity require it, a tin made to fit it; and in that tin another thin frame, covered with book-muslin, or other fine strainer, which floats on the liquid deposited for the sustenance of the bees. Here, then, is a feeder, containing the prepared sweet, in the immediate vicinity of the mother hive, and without admitting the cold or the robbers to annoy the bees. When the drawer thus prepared with bee-food is closed, the tin placed over the semilunar aperture must be drawn, which will open to the bees a way to their food in the drawer beneath. The heat of the hive follows the bees into the feeding department, which soon becomes the temperature of their native domicile. The box-fronts on each side of the feeding-drawer are formed of a bit of talc suspended over a hole on the outside, thus permitting egress, but precluding ingress. By means of this contrivance, the number of bees may be increased without alarming or annoying them, and they can likewise escape when being deprived of one or other of the collateral boxes. This contrivance further precludes the intrusion of insect enemies.

The centre is perforated on the top, and over the hole a bell-glass is placed, which, when the hive is filled, the bees fill with honey which is of the purest description. Wooden fittings or covers are provided for the protection of these glasses.

The bees, being placed in the centre box, or pavilion, soon commence operations, and speedily fill it with honey. When full, which may be ascertained by looking through a window fixed in the back of the box, the tin slide which separates it from the bell-glass must be drawn; this is best done on a warm day, and the comb should previously be cut through with a thin wire. Before taking off the glass, the operator should pause for a few minutes, to observe whether there be any unusual stir among the imprisoned bees; for if they do not appear alarmed, the queen is among them, and in that case the slide must be withdrawn, and the operation postponed to another day.

In taking away the glass, envelop it in a silk handkerchief, and remove it about ten yards from the boxes; then place it a little on one side, so as to permit the imprisoned bees to escape, which they will do in a few minutes. When occasion requires, the bees are to be similarly admitted into the side

boxes, by drawing the slides ; but in removing one of these boxes some precautions require to be used. For instance, open the ventilator the night previous ; this will, by lowering the temperature of the hive, and admitting a current of air, induce the bees to leave the box thus treated, and to congregate in the pavilion. Then put down the slide D, and let the bees remain for ten minutes or so in darkness. If the queen be not in the box to be taken, any bees that may remain in it will be restless and in confusion. If she should be there, the commotion will be in the centre box. If the queen should be in the box intended to be taken, draw up the slide again, and she will soon leave it. Having emptied the full box, return it to its place. According to this system, fumigation is unnecessary, — a child, even, may manage the boxes with ease and safety. The centre box, called, on account of its being the breeding place, the pavilion of nature, is never to be meddled with.

Any person of common ingenuity can form for himself a set of collateral boxes, by taking as a stand a piece of strong wood — deal, obtained from an old door, or other waste timber ; let it be about four feet long and about two feet wide, as thick as can be procured ; place it on four legs, and let the edge project over the legs, in order to prevent the incursion of insects ; plane the upper surface smooth. Make three boxes, each about ten inches square, with, of course, no bottom, and have the edges of the bottomless portion planed smooth, so as to lie as close as possible to the board. Cut away a portion of the bottom of one side of each box, and in that designed for the centre box do so on two opposite sides ; — these are for communication. Get two sheets of tin, or thin wood, — a piece of a broken tea-chest will do admirably, — and place one between each of the collateral boxes and the centre one, so as to cut off communication between them, until it is desired to open it, when, of course, one of them is withdrawn, and, at the same time, the side box, thus opened, will be pushed close to the central one. Let the stand-board be on an inclined plane, sloping towards the front, so as to throw off wet, and let the said board project a couple of inches, to serve the bees as a place on which to alight. Make a small hole, about half an inch, or rather less, in diameter, in front of this centre box, partly in the box and partly in the board, for the ingress and egress of its inhabitants. Paint the boxes externally, but do so a considerable time before they are required for use, and encompass them with the best sort of rough shed that can be conveniently put up ; bore a hole, with a centre-bit, in the top of each box, and place a glass vessel over it. When it is necessary to feed the bees, it can be done by attaching a feeder to the entrance door, and the holes for the bell-glasses will afford ample means of ventilating. In case they should not, however, have a hole at the back of each box, stopped with a cork, which can be withdrawn for the admission of air when necessary. Take care that

the cork be not pushed entirely through the wood of the box, or it will be so cemented by propolis that it cannot, perhaps, be drawn out without injury or disturbance to the combs.

Another mode of forming bee-boxes is as follows: Let them be of as good quality as possible, so as to effectually preserve their contents from either extreme heat or cold, dampness, or any sudden changes of temperature. The size of the centre box should be about ten and one half inches cube, inside measure; and it would be of advantage to have six bars fixed across the top of it, from front to back, which should be one and one-eighth inches in width, half an inch in thickness, and half an inch apart—the ends of each of which should be neatly rabbeted into the front and back of the box. Over the bars should be laid a piece of thin gauze, and upon it the top or covering-board of the box, which may have a circular hole in the middle of it, securely stopped by a good cork-bung, to be removed for the purpose of placing a small bell-glass over the hole, as occasions require. The side boxes may be made and used of different sizes, if desired, and to contain from 350 to 1100 cubic inches each. If the smaller sizes are adopted, the entrance to them must be along the hollow part of the bottom-board; but it would be considered more complete to have the side boxes of the same width and depth as the centre one, and to have them well fitted and secured together during the honey-gathering season. The entrance from the centre to the side boxes may then extend along the under edges of each of them from front to back, and about three-eighths to one-half an inch in depth; there should also be a perpendicular one, three inches long and half an inch wide, up the centre of the end of each of the boxes, the upper part of which should reach to within three inches of the top of the box inside.

The use of bars to the top of boxes is frequently of much service to the apiarian, as he can thereby occasionally remove a few of the old combs from the box, and can, at any time, have an opportunity of examining the state of the interior of the boxes. Before using a new box with bars, as above, a piece of pure and clean brood-comb should be neatly fixed to each, on every alternate bar, which may be readily accomplished by the assistance of a long and smooth piece of heated iron—the comb, being rubbed for a few seconds on the iron, should immediately be applied to the bar, and will then, in a short time, firmly adhere to it.

The use of *hives of straw* is by many persons still continued and approved; and there is no doubt that, when properly made and judiciously managed, the returns from them will often equal, or surpass, those from some of the more fancy-shaped and costly wooden boxes.

The size of the straw hive should be from sixteen to seventeen inches in diameter, and twelve to thirteen inches in height; and they should have a

narrow, flat, and thick top of wood, with a circular hole and cork-bung in the centre of it, similar to that for wooden boxes. The outer box, in which the stock-hive and side boxes are enclosed, having been made wider than the interior hives or boxes, should have a partition from front to back, on each side of the stock-hive, and the interstices round the centre hive filled up with dry sawdust, powdered charcoal, or other suitable materials, which will be of service in preserving the temperature of the hive in a congenial and uniform state. The communication from the straw stock-hive to the side boxes should be along the hollow centre of the bottom-board; three or more circular holes should also be made in the bottom-board on each side, in such manner that each of them may be covered with a bell-glass, or that one of the larger side hives or boxes may be placed over them, as may suit the wishes or convenience of the apiarian. When glasses are used, they should be well covered with some soft woollen materials, and a hive or box should then be placed over them, to effectually exclude the light, and preserve them from accidents of any kind, and sudden changes of temperature. It is advisable to have the outer box well made, with a neat and substantial roof to carry off the wet, &c., and it should be made of such breadth as to leave a space of one half inch on each side of the stock-hive.

A well-informed writer observes, that, if the bees are kept in a straw hive, it should be of a large size, and well made, and should be stocked with a strong swarm at the usual period of the year. It should be then placed on the centre of a stout bottom-board, made long enough to hold a small hive or box on each side of it, and having hollow communications from the centre hive to the side ones, which can be opened or closed at pleasure. When the bees require room in the spring or summer months, the entrance from the centre to one of the side hives must be opened, and after they have fairly taken possession of it, it must be properly ventilated by a hole previously formed on the top, and covered with a piece of perforated zinc, keeping the temperature between 65° and 75°. The three hives should have a well-made wooden covering over them, with a span-shaped roof to carry off the wet, &c., and an opening at the back for the purpose of examining the progress of the bees; the outer box should be well painted, and water-proof, and will greatly assist in regulating the temperature of the hives, and in protecting them from extreme cold, dampness, or sunshine.

It matters not much of what wood the boxes are made, provided it is sound, thoroughly seasoned, and well put together. Different opinions are entertained as to the size of bee-boxes; but much depends on the number of bees they are to contain, and on the honey locality; there must also be a reference to the proposed mode of working them, for, where no swarming

is permitted, a larger hive may be advantageously used. A good size is twelve inches square, and nine inches deep within, the thickness throughout being not less than an inch. The top of the box ought to project on all sides nearly three quarters of an inch, for better protection and appearance, and as affording convenience for lifting. On the top a two-inch hole should be cut in the centre, for placing a bell-glass, and for the purpose of feeding ; and another hole, to receive a ventilator, may be made near the back window, that position being better for inspection, and less in the way of the bees, than the centre of the hive, which is, or ought to be, the seat of breeding, and should not be disturbed. A window may be placed at the back and front, five inches high and six or seven inches wide. The best and neatest way of securing the windows is by a sliding shutter of zinc. This passes into a rabbet to receive it, cut, on the remaining three sides, at the back of the lower edge of the moulding. To prevent any wet from lodging at the bottom moulding, an opening or two may be easily cut through, on the under side, to allow its escape. Place the hive under some cover or shed, as a protection from wet and heat.

The "*Leaf Hive*," invented by Huber, consists of eight frames, each eighteen inches high and ten inches wide inside, having the uprights and top cross-pieces one and a half inches broad, and one thick, so that the eight frames, when placed close together, constitute a hive eighteen inches high, twelve inches between end and end, and ten inches between back and front, all inside measure. The frames are held together by a flat sliding-bar on each side, secured by wedges and pins. To the first and eighth of these frames is attached a frame with glass, and covered with a shutter. The body of the hive is protected by a sloping roof, and the entrance is made through the thickness of the floor-board. Some dislike the sliding-bars, with their pins and wedges, because, in drawing them out, all the frames are liable to open, and the observer is exposed to some hazard of annoyance from the bees issuing out at every joint ; as a substitute for them, place hinges on one side, and a hook-and-eye on each frame on the other, and thus any particular leaf may be opened without meddling with the rest. In taking honey from this hive, the bee-master has the whole interior completely under his eye, and at his disposal ; and can choose what combs best suit his purpose, both as to quantity and quality, taking care, however, to do so only at such periods as will leave the bees time to replenish the vacancy before the termination of the honey season. It is also well adapted for artificial swarming. By separating the hive into halves, the honey, brood-combs, and bees, will, generally speaking, be equally divided ; and by supplying each half with four empty frames, there will be two hives, one half empty, equal in number of bees, of brood, and even of stores. One

of the new hives will possess the queen, and, if the operation has been performed at the proper time, — that is to say, a week or ten days before the period of natural swarming, — the probability is, there will be a royal brood coming forward in the other; at all events, there will be plenty of eggs and larvæ of the proper age for forming an artificial queen.

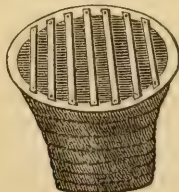
With regard to the use of sticks or cross-pieces, some object to them, as only an annoyance to the bees; and there is little fear of the combs falling, except in very deep hives, — at any rate, it may be prevented by contracting the lower part a little. The best way of doing this is by working a wooden hoop inside the bottom band of the hive; it should be perforated through its whole course, and the perforations made in an oblique direction, so distant from each other as to cause all the stitches of the hive to range in an uniform manner. The hoop gives greater stability to the hive, preserves the lower edge from decay, and affords facility in moving it. A circular piece of wood (turned with a groove at the edge, to retain it in its place) should be worked into the crown, having through it an inch-and-a-half hole. With a little ingenuity, the bees may be fed through this opening, — a better method than the ordinary one, at the bottom of a hive. A piece of wood or tin will commonly cover the hole; but at times, especially in winter, it may be used for the purpose of ventilation, and allowing the impure air of the hive to escape. In this case, a bit of perforated zinc or tin should be placed over it, which, when stopped up by the bees, can be replaced by a clean one. An earthen pan is a common cover to a straw hive; and this may be slightly raised by wedges on the four sides, to permit a small space underneath. Of whatever material the outer covering consists, it must project so far on all sides as to protect the hive from the least moisture. This cannot be too much guarded against; and whether of wood or straw, all hives ought to be well painted at the beginning, and kept so.

To have a *simple and cheap hive*, get a common straw hive, of somewhat larger dimensions than common, and cut it across (about one third of its length) from the upper or conical end; fit to this end a round piece of wood about an inch in thickness, having in its centre a hole about an inch and a half in diameter, fitted with a cork or bung. Take another hive of ordinary dimensions, and place it over this. This is called capping. When, during the proper season, the bees have filled the lower part of the hive, and show symptoms of requiring more room, you have only to draw out the cork, and place the cap over the board. This acts as a bell-glass, and the honey which will be collected in it will not be inferior to that procured from the most costly set of bee-boxes. A coating of Roman cement on the exterior surface of these hives will render them almost everlasting.

Glass hives are not to be recommended. Bees love darkness, and hate light or observation. In a state of nature they seek some hollow, vacant spot beneath a bank or rock, the cleft of a tree, or some similarly dark and secluded place.

Huish is of the opinion that straw is the best material for making hives, because it is clean, wholesome, dry, impervious to the effects of the weather; and being a warm advocate for the deprivation of a hive, in preference to the massacre of the bees, the particular shape of the hive became a matter of the first consideration, and secondly, so to construct it that the use of the sticks could be entirely abolished. In some parts of Greece, the hives resemble exactly a large flower-pot, and he considered that that shape offered to him every advantage which he was desirous of obtaining. The combs, being begun at the top, would necessarily be larger than at the bottom, and thus, acting on the principles of the wedge, they would be prevented from falling down, and the extraction of them from the top would, in comparison from the bottom, be a matter of great facility. In order, however, to effect the extraction of the combs from the top, it was evident that that advantage could not be gained were the top of the hive to be of one piece, for as such it could not be lifted without moving the whole mass of the combs, which, in the first place, would be next to an impossibility, and, in the second, would tend to the utter ruin of the hive. Having, therefore, constructed a hive of the shape of a flower-pot, making the diameter of the base not much smaller than that of the top, he placed a projecting band at the top, on which he placed seven bars, according to the annexed figure. These bars are fastened to the band of straw by small wooden pegs, which are easily drawn out when a honey-comb is to be extracted.

Fig. 246.



With the knowledge that bees will not construct their combs on an insecure foundation, he placed a piece of network over the bars, of which the meshes are of a middling size, by which, in a degree, the bees were forced to attach their combs to the bars, and thereby rendering their extraction more easy. Over the network he placed a board of five divisions, attached to each other

by hinges, so that any part of the interior of the hive could be examined without exposing the whole. The network was evidently an annoyance to the bees, for in almost every instance the greater portion of it was nibbled away. In the lapping-board nine holes were made, over which plates of perforated tin were put, in order that the perspiration might escape, which prevents the combs assuming that black appearance which is in general so great an eyesore. According to this construction, the deprivation of the hive is very easily effected, and may be accomplished by the most timid person. The hive being covered with a top, according to the annexed cut, it is taken off, and one of the side flaps being lifted up, the position of the

Fig. 247.



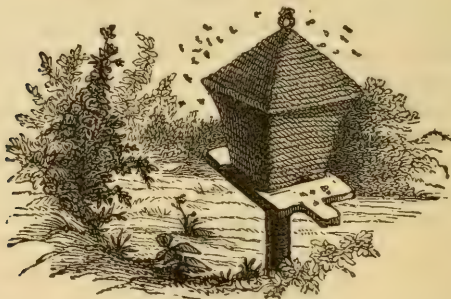
comb immediately exhibits itself. If it has not been constructed exactly parallel with the bar, the opposite side may be examined, and that comb selected for extraction which presents the greatest facility. It is, however, necessary that the operator should have in readiness a pair of bellows, to the orifice of which is attached a small tin box, with the lid and bottom well perforated, into which some old rags or dried leaves, in an ignited state, must be placed; and thus, being provided with the object most dreaded by the bees, — namely, smoke, — as soon as the flap is opened, and the bees present themselves, they can be driven away; and should they show any disposition to return, the repetition of the smoke will curb in them all future inclination to annoy the operator.

The make of Mr. Huish's hive was originally round. It was, however, soon discovered that that shape carried with it the disadvantage of having the side combs very small; and, therefore, after much trouble, he succeeded in bringing it nearly to the square, by which the side combs are nearly as large as those in the middle. Fig. 248 represents the hive.

Of late years, many new plans for bee-hives have been presented to the public, some of which are great improvements on the old modes of construction and management. Among these may be named Beard's, Colton's, Cutting's, Weeks', and Miner's; a still more valuable invention is that one patented by Arza Gilmore, Esq., which is commended by many of our most intelligent and skillful apiarists, as one combining in an emi-

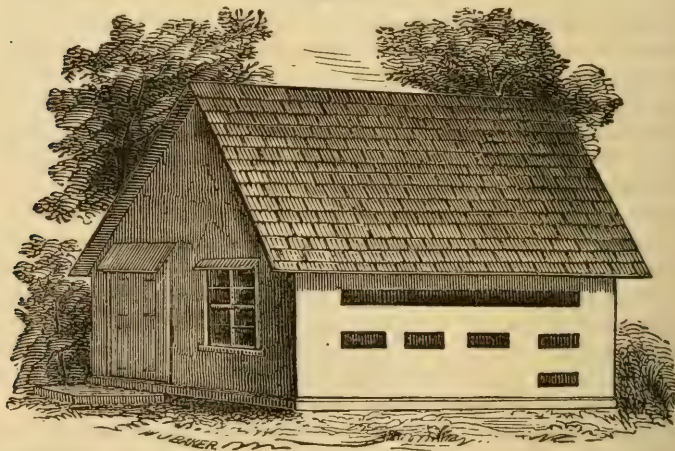
vent degree, all the requisites of a perfect hive, and its introduction is becoming more general than that of any other article now in the market.

Fig. 248.



The following is a perspective view of a bee-house, or apiary, on Mr. Gilmore's plan.

Fig. 249.



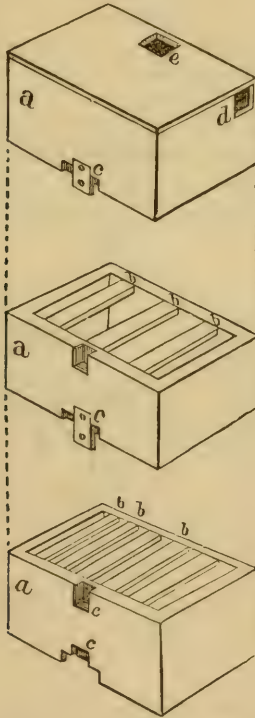
The above shows the front, with the openings for the bees — a door at the end, leading into the apartment back of the hives, where you can go, and examine the boxes, and inspect operations, unmolested. These houses may

be made plain or ornamental, according to the taste or desires of the proprietors, and of any required size.

In regard to the Gilmore plan, the first thing necessary will be to prepare a house or room, say eight or ten feet wide, and of any length you wish. In this, the hives and boxes are to be arranged as follows : —

The hives are made of the usual size, but in three parts, as represented by *a a a*. They are seven and a half inches high, ten wide, and fifteen long.

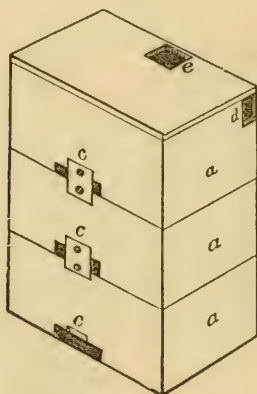
Fig. 250.



On the tops of all of them are slats or gratings made of wood, about an inch in width, and about a quarter of an inch apart. They should be apart far enough to let the bees pass through easily, but not so far apart as to allow them to build comb that would project through the grating, and connect with comb below. The object is to be able to remove parts of the comb in the

hive when it gets old, and by sliding in a new section of hive, give them a chance to renew it. In this way, all the comb may be renewed in each hive, from time to time. There is much advantage in this, for the bees are not only more healthy and active with new, freshly-made comb, but, in process of time, the cells, where the larvæ are raised, become narrow and filled up with bread, and the *exuvia* of the growing young; hence, bees bred in such places are not so large and strong. This arrangement of hives enables the bee-breeder to remove the old, and give the bees a chance to manufacture new. These sections of the hive are held together by bits or small cleats of wood, represented by *c c c*, which are fitted into slots cut in the edge of each section, and held in their places by small wood screws. On the top of the hive, as at *e*, is an orifice or hole, which may be closed by a slide, and also a similar one on the sides, at *d*. These are for the purpose of allowing the bees to pass from hive to hive, as they are placed in contact with each other, and should be four or five inches square. They can thus pass through the opening *e*, in the top, into the hive above, or into the hives on either side, through the opening *d*, in the sides.

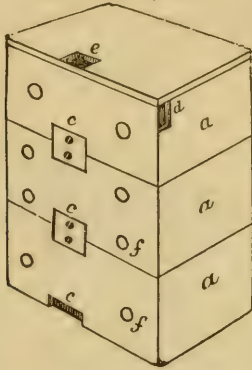
Fig. 251.



These sections, when put together, represent the front of the hive. It will be perceived that holes, or notches, are cut on each side of the cleats *c c c*, to allow the bees to pass and repass into and out of the hives, as is usual in common hives. Any number of hives are placed in contact with each other, side by side, and on the top of each other; and there is a communication throughout the whole, as above named, through the openings *c* and *d*.

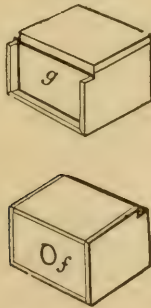
The next cut represents the back-side of the hive, where are seen the cleats *c c c*, and the openings *e* and *d*. In addition to these are holes *f f*, eight in number, bored with an inch or an inch-and-a-half bit. They are made to allow the bees to pass from the main hives into the boxes, which

Fig. 252.



are placed in contact with them, having an opening of the same size, to match. These boxes are made of thin, light wood, having a pane of glass in front, through which it may be seen whether they are filled with honey or not, before taking them away. They are seven and a half inches long, and four and three-fourths' inches high. The cut *g* represents the glass

Fig. 253.

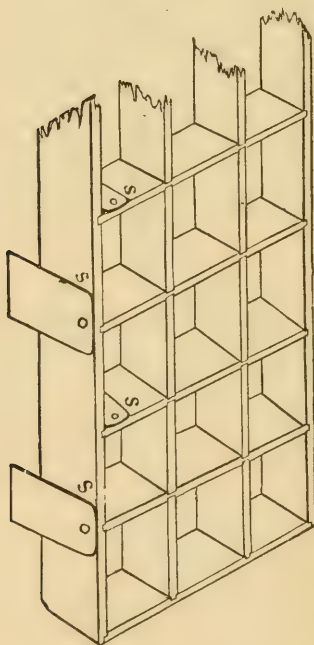


front; *f f* showing the opening on the back-side, corresponding with the hole *f*, in the main hive. These boxes are kept in their places by means

of a rack, similar to the rack or case in which small drawers are placed. This is shown in the succeeding cut, and is extensive enough to cover the whole of broadside of the hives — *s s s s* representing slides of wood, tin, or zinc, by which the communication between the hives may be cut off when desired.

These are the movable parts of the apiary. We will now proceed to arrange them in the house or room in which they are to stand. In order to

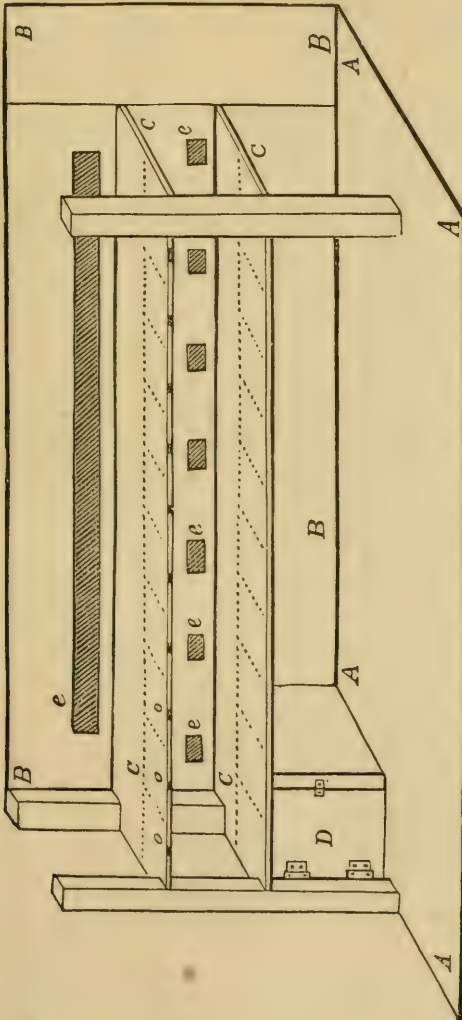
Fig. 254.



illustrate this arrangement, the interior of the house is seen with the back and ends removed, thus exposing the fixtures within. *A A A A* is the floor of the house ; *B B B B* is the front side. In order to let the bees pass out and in, small openings or doors are made, either in the form of a long opening, as in the shaded part represented by *c* in the upper part, or in the square shaded parts, *e e e e*, below. Long openings are preferable. All these openings are furnished with shutters or slides, by which they may be

completely closed, at will. The best arrangement for this is to have a long opening with a groove at the top and bottom of it, so as to return the slides

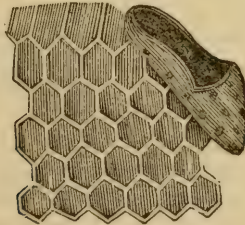
Fig. 255.



such part of the hives as you wish. Two wide shelves, *c c c c*, are then placed in the house, the fronts resting against the side of the house, and the ends attached to posts or scantlings, which hold them firmly in their place. Below the lower shelf, at *D*, is a closet sufficiently large to hold a common bee-hive. This has a door, to shut tight and keep it dark, and a small opening in the front. The use will be explained below. The dotted lines on the shelves represent the spaces covered by the hives, when in place ; *o o o* represent slots or openings through the shelf, corresponding with the openings in the top of the lower tier of hives, allowing the bees to pass through into the upper tier.

We will now place the hives, and the rack or case to hold the boxes, in their places, which will be represented in the last architectural figure, where *A A A A* show the floor of the house, *B B B B* the front side, *h h h* the tops of the upper tier of hives, *o o o* the ends of the slide regulating the passage from hive to hive. After they are all placed, the boxes are darkened by being covered with a curtain or shutter. These tiers of hives are represented as not extending the whole length of the house, but stopping two or three feet short of the right-hand end. At this end, the hives are perforated with holes, and a rack or case put up, which contains glass tumblers, lying on their sides, with their mouths applied to the holes in the hives. The bees enter these, and fill them with honey ; a partition is put up at the end of the shelves to keep the bees from entering the other part of the house, and windows, *w w*, placed there, so that a spectator can stand and look into the gallery in front of the hive, and see the bees pass and repass into and out of the house. The hives are placed back a foot, or a foot and a half, from the side of the house, which leaves free space for the bees, and enables them to attack moths, or other intruders. We will suppose that you have the hives and fixtures all arranged, and one swarm of bees at work in them ;

Fig. 257.



you may then add as many swarms as you can procure, in the following manner : You place the hive containing the swarm that you wish to add to

the swarms in the apiary, into the closet *D*, at the bottom of the house — shutting the door, making all dark except the small opening in front. In a short time, the bees will leave the imprisoned hive, and unite with the swarm in the house, and work quietly and peaceably with them. When boxes are taken from the cases, they will contain a few bees. Place them in the dark closet *D*, and they will soon leave, and unite with the other bees in their work.

The preceding cut represents a portion of the comb, or hexagonal cells of the bee, and also a cell for the production of the queen-bee, cut open, to show the difference of its form and size.

IV. OBTAINING STOCK.

Spring Stock. — A stock of bees may be procured either in the spring or autumn. The former period is, perhaps, to be preferred, because it is the fitting time for the removal of stocks from the old-fashioned, awkward hives. to the more improved modern receptacles ; but it is more difficult to ascertain the exact condition of the stock which may be purchased in spring than in autumn. If, during the months of May or June, a purchase is to be made, the garden, or other locality, in which the hive intended to be purchased stands, should be visited about mid-day ; stand opposite to it, and observe attentively the actions of its inhabitants. If they crowd busily in and out of the hive, giving evidence of their industry by the laden appearance of their legs, and altogether showing a busy earnestness in their toils, the hive may safely be bought, and if obtained before swarming has taken place, so much the better.

Autumn Stock. — If the object be to obtain an autumnal hive, it is well to ascertain, by observing the stand and the ground around the hive, that the massacre of the drones has taken place. Observe the actions of the bees — see that they are lively and industrious ; and if, on your too near approach, one or two bees dash at the face, it may be regarded as a sign of vigor. Some writers speak of the necessity of purchasing only such stocks as are in nice new hives. This is necessary to be attended to, but is not so important if the interior of the hive be filled only with honey-comb, and with no old, worn-out comb, the accumulation of years. If there is reason for doubt on the subject, fumigate the hive in the evening ; then, turning up the hive, the character of its contents may readily be ascertained. If the comb be black, have nothing to do with the stock ; the genuine color of the comb is white, and, consequently, the lighter it is, the better the stock.

To Secure Good Hives. — Unless the party can be depended on, it is best never to send the hive to receive a swarm ; otherwise a second swarm may be

furnished instead of a first swarm — a comparatively valueless stock for just the very thing desired. The *first* swarm begins the formation of the combs at the *middle* of the apex of the hive ; the *second* does so at the *side*.

The person who intends to erect an apiary should purchase a proper number of hives at the latter end of the year, when they are cheapest. The hives should be full of combs, and well stored with bees. The purchaser should examine the combs, in order to know the age of the hives. The combs of that season are *white* ; those of a former year are of a *darkish-yellow* ; and when the combs are *black*, the hives should be rejected, because old hives are most liable to vermin and other accidents. If the number of hives wanted have not been purchased in the autumn, it will be necessary to remedy this neglect after the severity of the cold is past in the spring. At this season, bees which are in good condition will get into the fields early in the morning, return loaded, enter boldly, and do not come out of the hive in bad weather, for when they do, this indicates that they are in great want of provisions. They are on the alert on the least disturbance, and by the loudness of their humming we judge of their strength. They preserve their hives free from all filth, and are ready to defend them to the utmost.

The summer is an improper time for buying bees, because the heat of the weather softens the wax, rendering the comb liable to break, if they are not very well secured. The honey, too, being then thinner than at any other time, is more apt to run out at the cells, which is attended with a double disadvantage, viz., the loss of the honey, and the daubing of the bees, whereby many of them may be destroyed. A *first* and strong swarm may, indeed, be purchased, but unless it is permitted to stand in the same garden until the autumn, it should be carried away in the *night*, after it has been hived.

V. SWARMING.

Time of Swarming. — Bees multiply, during the breeding season, with astonishing rapidity ; it is, therefore, not to be wondered at that the young brood should speedily produce *crowding* in the hive, thus becoming not only inconvenienced for room, but more than agreeably warm ; it is also supposed that the queen becomes alarmed at the number and progress to maturity of the royal larvæ, which, indeed, she would fain kill, were not she prevented from doing so by the workers. While swarming is by no means to be forced, yet, if symptoms of a swarm present themselves early, say in April or May, it may be permitted to take place, provided the parent stock be still sufficiently strong in numbers ; otherwise, it is, of course, highly disadvantageous to the well-being of the hive, as well as to the emigrants.

Indications of Swarming. — The most certain indications of swarming are,

the hive appearing full of bees — clusters of them gathering on the outside and sometimes hanging from the alighting-board ; they also neglect their

Fig. 258.



daily toil, and refrain from going abroad in search of sweets, even though the weather be very fine. Just before they take flight, the hive is hushed, the bees are silent, and carefully loading themselves with provender for their journey. For two or three nights prior to swarming, a peculiar humming noise may be heard within the hive ; the second swarm is announced by a different sort of buzzing, being, according to some writers, the result of a contest as to which of the two queens shall lead off from the hive. The old queen leads off the first swarm.

To Prevent Swarming. — If a swarm be about to quit the hive, the slightest change of weather will prevent their doing so, but nothing so effectually as a shower of rain ; hence, an excellent mode of preventing it, when the bees cluster on the outside of the hive, is by syringing them with water from a common metallic syringe. When a swarm leaves the hive, if it do not

settle and there is fear of its going to too great a distance, throw up dust. Secure the swarm, at once for bees send scouts to select a new place.

To Secure a Swarm that has Settled.—When the swarm settles, the bees collect themselves in a heap around the queen, hanging to each other by means of their feet. When thus suspended from a tree (Fig. 258) hold an empty hive under them, and tap the branch. They should then be sprinkled with honey and ale, and confined for about twelve hours. When a swarm divides and settles separately, it is probable there are two queens. One of them must be secured. If a second swarm comes off, as soon as it is hived, secure the queen, and return the swarm to the hive; deprived of its queen, it will usually immediately return of its own accord. Many persons suppose that the greater the number of swarms the richer will be the hives in August. The very reverse of this, however, is the case.

Electricity.—A famous German apiarist has successfully used electricity to enable him to manage bees when swarming. An electric shock it was found would temporarily stupefy the bees. Both large and small clusters were found to be completely under the influence of the shock. Even single insects could be operated on. The moment the bees touched the operating wires they dropped motionless to the earth. You could then handle and sort them as you pleased, and they remained stunned for a time proportionate to the strength of the shock. All, however, came out of their swoon quite well. To fully test the question, the operator determined to experiment on a large scale. With this end in view he placed the ends of two conducting wires in a honey-comb filled with bees, and turned on the current; in a few seconds all the bees succumbed, and it was all of a half hour before their vitality returned. Then they resumed work as though nothing had happened.

Effects of Swarming.—Mr. Briggs, a distinguished apiarist, remarks that most persons who keep their bees on the old straw-hive plan, and suffocating system, appear to anticipate their swarming with much anxiety, and think that the greater number of swarms,—firsts, seconds, thirds, &c.,—that they obtain from their old hives during the summer, the more remunerative will they prove to their owner at the end of the season; whereas the reverse of the above practice is much nearer of being the best system to follow. June is the principal month for swarming, in ordinary seasons; and it is in June and July that the greatest quantity of honey is stored up by the bees. When the swarming is assisted and encouraged during June and July, the old stock are considerably weakened, and the swarms are employed in building combs in new hives, collecting pollen, and attending to the young brood, until the best part of the honey-storing season is over; so that, at the honey

harvest in autumn, it will frequently require the contents of five or six old stocks, or late swarms, to produce as much honey as might have been obtained from one colony on the system of management which is recommended.

To Avoid Swarming, in the Case of Collateral Boxes. — In collateral boxes, and in capped hives, swarming may be prevented by affording the bees additional accommodations, and reducing the temperature; and for this end, it is recommended, by most apiarists, that the hive or box should be furnished with a thermometer, as well as a ventilator. Those, however, who do not possess these accommodations, may manage well enough, by proper observation and attention to the symptoms which have been detailed. When these appear in a collateral box-hive, open one of the partitions, and admit the bees into a new apartment; if all be full, take off a box, empty and restore it. In the case of a capped hive, remove the bung, and admit the bees to the cap; if full, remove, empty, and restore it. The most favorable degrees of heat for the prosperity of the brood are from 75° to 90° in the stock-hive, and from 65° to 75° in the side boxes. The heat, in a prosperous hive, is sometimes upwards of 70° in December, and will, in hot summer weather, sometimes rise to near 120° , at which time the combs are in great danger of being damaged, and of falling to the floor of the hive; this may, however, be prevented, by giving extra room when required, and by shading the hives from extreme heat, as previously directed. And again, it should always be borne in mind that all operations with bees should be performed as carefully and speedily as circumstances will permit, so that the bees will scarcely know that their habitation has been meddled with. After hiving a new swarm, if unfavorable weather follow their departure, feed them, otherwise they will be starved; indeed, it would be well if each new swarm were always fed for a few days, as this will assist them in gaining strength in numbers and in store, before the principal part of the honey season goes over. The weight of a good swarm should be from five to seven pounds, and all under five pounds in weight should be united to others. In hiving a swarm, it is well to be protected with a proper bee-dress. Some persons are particularly unhappy in possessing those qualities which render them disagreeable to bees. The main objections are, excessive timidity, and likewise, with some, an unpleasant odor, in some instances the result of personal negligence, but frequently of peculiarity of constitution. The remedies are, a bee-dress for the former, and the use of some strong perfume which the bees like, and which will effectually conceal whatever is offensive to them.

Some writers on bee management have suggested other modes to prevent objectionable swarming, besides the collateral boxes and the capped hive.

Among these plans may be mentioned storifying or piling, and eking. The latter is speedily disposed of; it consists of adding ekes, or additional bands of straw, to the bottom of the common hive, according as additional room is required. The objection is, that, although it may thus answer the purpose during one season, the next involves as much perplexity as ever.

Adaptedness of the Different Hives.—The objections urged against the storified hive are, first, that it occasions the bees greater trouble and labor, rendering their labor less productive; second, the absence of provision for dividing the ordinary cells from the more peculiar and mysterious operations of the queen, and of course a consequent deterioration of the honey in respect to purity, besides much inconvenience and waste of time to the poor bees, —for a laden bee cannot mount up from one box to another, and through a labyrinth of comb, with anything like comfort and ease; thirdly, in taking a box of honey, the proprietor cannot be certain of not taking away a quantity of brood-comb, &c., —though this objection may be classed with that which rests on the impurity of the honey, with this additional one—that this also refers to loss of life which the bees, both brood and adult, must thus sustain; and fourthly, in consequence of these objectionable circumstances, which are the inevitable consequences of the piling system, the profit accruing from such management will be far inferior to that obtainable by the system already recommended.

It is said that in piled boxes bees are subjected to unnecessary labor, which is so far a waste of time. From piled boxes not nearly the quantity of honey and wax is procured that may be procured from collateral boxes; nor is that deficient quantity of a quality at all comparable with the other. In managing piled boxes many bees are destroyed.

VI. — THE HONEY HARVEST.

Time and Mode.—Those who possess collateral boxes may begin taking a box or a bell-glass very early in the season, —indeed, even so early as May or June; this must be, of course, dependent on the state of affairs, and on their own discretion. Those who keep their bees in the capped hive may also get a cap full of honey in or about the middle of June. The real honey harvest, however, is that which should take place in the beginning or middle of August. With reference to the collateral hives, no instructions need be added to those given when describing Mr. Nutt's boxes.

The old mode of obtaining honey was, as is well known, by suffocating the inmates of the hive. "*Fumigation*" is a word employed by bee-keepers to express the process in which, by the aid of certain intoxicating smoke, the insects become temporarily stupefied; in which state they are perfectly harmless, and may be deprived of their honey without any risk or trouble.

They subsequently recover from their stupefaction, and are nothing the worse for it. The dried fuzz-ball, and the frog-cheese, are much used for the purpose; but, in their absence, rags steeped in a solution of saltpetre, or a few tobacco-leaves wrapped in brown paper, will do nearly as well. If tobacco be used, care is necessary, lest the fumigation be carried to too great an extent, so as to cause the death of some or all of the stock. Persons not accustomed to deal with bees should wear an over-all of thin gauze over the head and breast, and gloves on their hands. With this, and a little bottle of aqua ammoniæ, or aqua potassæ, to be used in case of accident, they can go to work with coolness and deliberation.

There should be provided, for the purpose of fumigation, a small tin box, with a tube extending from each of two opposite ends; one end of this tube being so fashioned that it can readily be inserted into the hive, and the other so

Fig. 259.



formed that it can readily be attached to the tube of an ordinary bellows. The box should be so formed that it can be opened at pleasure. In this box the matter to be employed in fumigation is first placed, having, of course, been previously ignited; and the proper end of the tube having been inserted into the hive at the lower part, ply the bellows gently. The bees begin at once to feel the effects of the smoke. At first an unusual humming and commotion will be heard, but in less than ten minutes all will be still. The bees will fall upon the board under the hive, and lie quite still, as if dead. The hive may then be removed, and a fresh hive—the interior well smeared with honey—may be placed over them, or they may be united to another stock, which should also be previously fumigated, one queen being removed. Some persons may conceive it to be a difficult matter to come at the queen. When fumigation is resorted to, she is, of course, easily discovered; but even when it is dispensed with, and the practice adopted which will presently be described, she is not so very difficult to come at; for, on a hive being turned up and *tapped*, the queen is among the first, if not, indeed, the very first, who makes her appearance. The queen usually lodges near the crown of the hive, and is, when fumigation is resorted to, one of the last to fall; she will, therefore, in this case, be found amongst the uppermost bees. In practising fumigation, two persons should act in concert, each taking a hive and operating upon it, in order that both stocks should

be simultaneously in a similar condition as to intoxication. The hive must also be well covered with a cloth, to prevent the escape of the smoke. When the two stocks have been united in the manner described, it is advisable to confine the insects to their hive for that night and the following day. Do not, however, wholly deprive them of air in doing so, or they may be smothered. On the evening of the following day, about dusk, uncover the hive, and open the entrance. The bees will probably at first tumultuously issue forth, but, finding the lateness of the hour, will as hastily return. It is necessary to be cautious at this time.

The most suitable period of the year for uniting weak with strong stocks is from the middle of August to the latter part of September. This, however, is not a proper time to remove stocks from straw hives to boxes, for the season is too far advanced. When taken from their warm hive, and removed into a cold box, bees rarely recover from the effects of the fumigation sufficiently to resume business. May or June is the best time for this removal, or perhaps still earlier, — say the beginning of April, — before the eggs of the queen-bees have attained the stage of larvæ. If the operation be performed in cold weather, it is recommended that it be done in a room where the temperature is about 60°. Twelve hours, or thereabouts, suffice for the recovery of the bees, and they may then be removed with safety to their ordinary stand.

To prepare the fuzz-balls, put the ball into a piece of stout paper, and compress it as tightly as you can; tie it up closely in this condition, and put it in a moderately-cool oven, — about as cool as that from which bread has just been withdrawn; — let it remain there until it will serve as *tinder*. The quantity of the prepared fungus necessary for the fumigation of a hive is a piece about the size of a hen's egg, — less *may*, in some instances, answer, but it is better to have too much than too little. Prior to union, — even where fumigation has been employed, — the sprinkling with ale and liquid honey should not, on any account, be omitted.

The system which dispenses altogether with fumigation, called *tapping* or *driving*, is spoken of favorably by some writers. It is as follows: — When daylight has died away, and twilight appears, the bees will all be quietly reposing, unsuspectingly, in the hive; — let whoever is in the habit of tending the bees be the agent in the process; — no assistance is necessary; — let him or her take an old chair from which the bottom is out, — a worn one is best, as it best fits the reversed hive, — turn up the hive on the chair, and place over it an empty one, which has been smeared interiorly with honey, or sugar dissolved in beer; wrap a cloth around the point of junction, for the first few minutes, and with a stick tap the reversed hive round the sides, beginning near the bottom, and gradually ascending in your strokes,

towards the top ; let the strokes be not too rough, lest the combs be loosened.

Ere this operation has proceeded very far, a humming noise will be heard, and presently the disturbed bees, more than half asleep, will mount into the upper hive. If the ascent of the bees appears checked, before all have left the lower hive, remove the cloth,—which, by the way, is no longer necessary, when once the ascent has commenced,—and raise the upper half an inch or so above the lower. This will be found to facilitate the emigration, and will be unattended with danger. The lower hive being fully deserted, place that containing the bees on the stand. Some like to close the aperture for a time, but this is useless.

First Harvest.—The most secure mode of procedure, and the most approved, is to unite the exiled bees with those of another hive. Remember always to leave the bees a sufficient store of honey as food. This is usually done by setting apart what is called a stock-hive,—a hive well filled with honey, and capable of containing and supporting more bees. Turn up this stock-hive, and sprinkle its drowsy inmates, or rather drench them, with sugar or honey, dissolved in beer. Do the same with the exiles ; and once again invert the abode of the latter over the mouth of the inverted stock-hive. Proceed in other respects as before ; and, by tapping, drive them down. The two families rapidly recover from their surprise, and the agreeable employment afforded to all their individual members, of licking the results of the sprinkling from each other's bodies, will soon produce friendliness, and meanwhile the liquid with which you have saturated them will prevent their distinguishing betwixt stranger and comrade. Of course, precaution was taken previously to remove the queen of the swarm to be united to the stock-hive. This is the *first* harvest.

Second Harvest.—By adopting the following approved system of management, a second harvest may be obtained, before placing the bees in their winter quarters. This latter operation is termed *shifting*.

From the middle of August to the end of September is the usual time when we perceive the food of bees beginning to fail them. This is the period for removing them to the “heather,” which is then in bloom. Before moving, ascertain the condition of the hives ; for those which are well stocked with honey should be *deprived* by the process already detailed, and this should be done some days prior to removal, for the combs containing the young may have been loosened in the operation, and the bees should be allowed time to fasten them once again securely in their places.

Water carriage, when procurable, is the best, as it shakes the hives

least; but when land carriage must be resorted to, the hives should be carried on poles, slung on men's shoulders. The journey should be pursued at night only, and the bees suffered to go forth and feed during the day. Such is their instinct, that they will readily find their way back; but they should not be suffered to go forth until at the distance of upwards of ten or twelve miles from their original home, otherwise they will be lost in endeavoring to regain it, — a moderate distance induces them to abandon the idea, and to become reconciled to their new quarters. If traveling by canal, the hives should be removed from the boat, and placed on stands, at some distance from the bank, ere the insects are let out, otherwise they will be lost in thousands by falling into the water on their return.

Examining and Weighing. — About the middle of September, examine your hives; at all events, do not, whatever be the aspect of the season, neglect this necessary operation until October; but if the season appear likely to turn out to be a severe one, set about it even earlier than the time named. Understand, however, that the bees cannot be deprived of any honey so late as this.

In glass or observatory hives, and such as are formed on the collateral-box or piled-box principle, there are usually such contrivances as will admit of inspection of the hive and its contents without handling it. In the ordinary hive, however, we cannot avoid manually ascertaining the weight and condition of the stock. In order to do so, a previous acquaintance with the weight of the hive, and of the probable number of bees which it contains, is necessary; and it would be as well to have the stands so contrived as to admit of their being raised with the hive for the purpose of weighing, as, if the latter be forcibly separated from the former, the cement of propolis gets broken, — the substance which unites the hive to its position on the stand, — and annoys and troubles the bees.

A hive should contain twenty pounds of honey for its support during winter; but it is a mistake to suppose that an increase of number in the hive, produced by union, will require an increase of food. In fact, precisely the contrary is the case; and the more abundant the stock of the bees in autumn, the richer and the better able to work will they be in spring, — the more forward, therefore, will they be in summer, and the greater will be the profit. The weight of honey, above named, is, of course, exclusive of both hive and bees. In one pound — sixteen ounces — there are about five thousand bees; from fifteen to twenty thousand bees constitute a strong hive, — that is, from four to five pounds in weight. If, after making these calculations and deductions, the stocks are found under weight, either supply them with food, or unite two or more together.

Age will cause hives to weigh heavier than their legitimate contents

would call for. This is occasioned by an accumulation of *bee-bread*, and the cast sloughs which had formerly served as envelopes to the young. In the case of old hives, therefore, allow from two to five pounds, according to age, for these matters. The substances referred to should be occasionally removed from the hive, as otherwise they will accumulate to such an extent as to render the hive too small for breeding, and the stock will thus soon become extinct. Spring is the proper season for removing these substances; — the process is very simple, consisting merely in fumigating the hives, and thus rendering the bees for the time insensible; then, while they are in this state, turning up the hive and cutting out a portion of the old comb, — only cut away half at a time. The following spring, perform the same operation; — the gap made by the knife the previous year will be found completely restored, and the remaining portion of old comb may now be removed. By this system of constantly inducing a renovation of the combs, the stock may be preserved in a state of perpetual youth.

Duration of Hives. — The hive, even if made of straw, will last for an indefinite length of time, if protected externally by a thick coat of white-wash, or, which is better, Roman cement. Some object entirely to paint being used for this purpose. The cutting of the combs may also be resorted to in cases where the hives are infested with moths; under such circumstances, all the combs that contain the larvæ of those insects may be cut away.

Food for Bees. — With regard to food for bees, honey, when it is on hand and can be spared, is, of course, the best; but, if you cannot give honey, substitute for it ale and sugar, boiled gently together in a clean, well-tinned vessel, over a clear fire, for about five minutes. One pound and a half of sugar may be added to each quart of ale, and the mixture is to be skimmed, according as the scum rises to the surface, during boiling; when the syrup is taken from the fire, add to it about a tea-spoonful of common table-salt for each quart of syrup.

It is bad to be compelled to feed the bees in winter, as, by descending to the bottom of the hive in order to get at the food, they expose themselves to cold, and many perish; by early examination in autumn, and uniting weak hives, together with judicious feeding at that season, if necessary, the winter management will be simplified. Some persons defer feeding until the bees are absolutely in want. This is wrong; the assistance should be rendered several weeks before the hive is in a state of positive destitution, otherwise, when the food is given them, the bees will be too weak to partake of it. The best mode of feeding is, to put the honey, or syrup, as the case may be, into a shallow box; lay over the sweet liquid a sheet of strong paper, perforated with holes, through which the bees can suck the

syrup without falling into the mess, or becoming clogged by it. Attach the box to the mouth of the hive; the bees will soon make it out, enter, and remove the store to their cells. It is bad to lift up the hive for the purpose of feeding, as, by so doing, the temperature of the interior is lowered, and the stock often destroyed. When the feeder is attached to the entrance of the hive, all this is obviated.

VII. MANAGEMENT DURING WINTER AND EARLY SPRING.

Autumn and Winter Care. — One of the most important particulars connected with bee management is taking care that they are abundantly supplied with food in autumn, and also taking care at that season to ascertain whether or not they are sufficiently strong in *numbers*, and, if not, *unite the weak stocks*, so as to form *strong ones*. It is by such treatment as this that bees are preserved in health and strength during the winter, and in a condition to attend properly to their brood in the early spring.

Feeding. — In a large straw hive, there should be left, at the autumnal honey harvest, from twenty to twenty-five, or even, according to the size of the hive, thirty pounds weight of honey, exclusive of the weight of hive, stand, and bees. If, from any accident, the hive should be found deficient in weight, you must make up the deficiency by artificial feeding, either with honey, or with the mixture of beer and sugar, as has already been described. It is not, however, very strong evidence of the apiarian skill of any one who is compelled to feed his bees in the autumn; and, indeed, few should be obliged to do so, but those who use *too small* a hive, and whose swarms are consequently too weak, too feeble in point of number, to acquire sufficient wealth during the proper season for so doing, or from whom there has been injudiciously taken too much store, at a period too late in the season to admit of the bees replenishing the hive.

Narrowing the Entrance, and Covering. — Having ascertained that the stocks are supplied with sufficient quantity of food for their support during the winter, or that they are already possessed of enough, the next thing is to *narrow* the entrance of the hive so that it will scarcely admit of the passage of more than one bee at a time; and towards the middle of November the entrance should be closed nearly altogether. The hives should be covered up with matting, fern, or other similar substance, in order to preserve them from rain, frost, or, the most dangerous of all, the sun's rays of a fine winter's day. These deceptive rays would afford a temptation to the bees to sally forth, and the result would be that they would become chilled by the cold. Few would survive the flight so as to return to the hive; its temperature would fall, and the whole stock would be lost. The hives should remain thus carefully covered and closed until the beginning of March.

A coating of Roman cement, as previously mentioned, will protect the hives from cold in winter, heat in summer, from moths, and from wet. When there is snow on the ground, the entrances of the hives should be entirely closed.

Dampness, and Ventilation. — To preserve from internal dampness, during winter, carefully ventilate, placing a bell-glass, well covered with flannel, over the aperture on the top of the hive or box, removing it from time to time, and carefully wiping away from its interior the damp formed by condensed vapor.

Materials for Covering. — The materials with which hives are covered and surrounded should consist of dry leaves pressed closely together, or dry and powdered charcoal or cinders, and may be several feet in thickness, to preserve the bees in a cool and torpid state, and at a regular temperature, in which state they should be kept as dry, dark, and quiet, as circumstances will permit.

Spring Care. — As the spring approaches, the winter covering should be gradually removed, and those hives which have been buried placed in their summer situations. Small quantities of food should then be supplied, as occasion requires, until the gooseberry and currant-bushes are in bloom, at which time it may, in general, be considered that their winter is past. Warm weather, accompanied with moderate showers, is most agreeable to them at this period; and it is considered that flowers yield the greatest amount of mellifluous juices when the weather is calm and suitable as above, and with the wind blowing from any point of the compass from south to west inclusive.

Some pursue a mode of preserving bees by *interment* during winter. It consists of laying some very dry powdered earth upon the bottom of an old cask, to the depth of about half a foot, pressed down very hard, and setting upon this the stool with the hive; then preserving a communication with the air, by cutting a hole in the cask, opposite to the mouth of the hive, and placing a piece of reed from the mouth of the hive to the hole in the cask; then covering the hive up with a quantity of dry earth similar to that on which it stands.

In spring it is only necessary to remove the winter coverings gradually and with caution; to examine also the state of the bees' provisions, and, if necessary, feed them. Be cautious in at once giving them liberty, or in doing so too early, or in unsettled weather. Many bees lose their lives from neglect of these precautions, simple as they are, and obvious as their necessity must appear to every reflective bee-keeper. It is well, for these reasons, that the mouth of the hive should face due west, until all these dangers have passed away; of course, when the working season has arrived, all restraint

must be removed, the aspect of the hive moved southward, and the insects left entirely to themselves. When spring feeding is necessary, it is usually in April, for then the demands of the young brood call for a greater consumption of honey than ordinary; and from want of attention to this circumstance, hives have been lost so late in the season as the month of May. Spring, also, say about the beginning of March, is the proper time for transferring stocks from hives to boxes, remembering that the latter should be previously well cleaned out, their interior smeared, and supplied with a portion of honey, in a proper feeder. As the warm weather approaches, shade the hives from the sun. If the bees be induced by the heat to attempt injudicious or ill-timed swarming, and hang in clusters about the entrance of the hives, if advisable, it can be checked by sprinkling them with some water. They will mistake this for rain, and retire within the hives to resume their work.

VIII. HOW TO TREAT THE PRODUCE OF THE HONEY HARVEST.

Removing. — In the first place, remove the store to some room without fireplace, for the bees have been known to make use of even that mode of access in order to come at the honey, which they are able to scent from a considerable distance. Close all the doors and windows, previously having in the room whatever implements are wanted — viz., some large glazed earthen vessels, clean, new, horse-hair sieves, a strainer, some clean linen cloths, and abundance of water to wash in. Some recommend burning cow-dung, or rotten hay, at the doors and windows of the room in which the work is being done, in order to keep away the bees.

The Combs. — The first care should be to examine the combs, and free them from all dirt, grubs, young bees, or other foreign matters, remembering, of course, to have previously well and thoroughly washed hands. Then cut the combs horizontally into pieces of an inch wide, and lay them on the sieve over the glazed earthen vessels; when they have dropped all the honey that they will yield without squeezing, put them in the cloth already mentioned, and *wring* it over another vessel; this will furnish the *second-class* honey — that *spontaneously* yielded is called virgin honey, and is equal in purity to that obtained from the bell-glass. When all is obtained that can be by squeezing through the cloth or bag, carefully cover up the two sorts, put the comb, also well covered, into a vessel by itself, and remove all the other cloths, vessels, and other utensils, to the apiary, that the bees may lick them clean.

Obtaining and Preparing the Wax. — The next object is to obtain the wax. For this purpose, put the combs into a clean vessel, and add as much soft water as they will float in — distilled water would be best. but rain

will answer nearly as well. Place the vessel on a clear and not too hot fire, and watch it, stirring occasionally, until the combs be completely liquefied. Then strain this through a fine canvas bag, into a tub of cold water. The water first flows through, and then the bag requires *pressure* to make it yield the wax. A simple press recommended is, to have ready a piece of smooth board of such a length that, when one end of it is placed in the tub of cold water, the other end may be conveniently rested against, and securely stayed, by your breast. Upon this inclined plane lay the dripping, reeking strainer, and keep it from slipping into the cold water by bringing its upper part over the top of the board, so as to be held firmly between it and your breast. If the strainer be made with a broad hem round its top, a piece of strong tape or cord passed through such hem will draw it close, and should be long enough to form a stirrup for the foot, by which an additional power will be gained of keeping the scalding hot strainer in its proper place on the board ; then, by compressing the bag, or rather its contents, with any convenient roller, the wax will ooze through, and run down the board into the cold water, on the surface of which it will set in thin flakes. When this part of the operation is finished, collect the wax, put it into a clean saucepan, in which is a little water, to keep the wax from being burned to the bottom ; melt it carefully, for should it be neglected, and suffered to boil over, serious mischief might ensue, liquid wax being of a very inflammable nature ; let it be melted over a slow fire, and skim off the dross as it rises to the top ; then pour it into such moulds or shapes as may be desired, having first well rinsed them, in order that you may be able to get the wax, when cold and solid, out of them, without breaking either the moulds or the wax ; place them, covered over with cloths, or with pieces of board, where the wax will cool slowly, because the more slowly it cools, the more solid will it be, and free from flaws and cracks. The wax may be bleached by re-melting it, and running it several times into very thin cakes, suffered to cool, and exposed to the influence of the air and sun. This will render it white. The honey may also be clarified by placing the vessel containing it in hot water, and continuing to skim as long as any scum arises. In order to preserve it, it should be stored in jars, well bladdered and otherwise secured, and kept dry.

IX. THE DISEASES AND ENEMIES OF BEES.

Diseases. — When properly attended to, and managed on the improved system, bees are neither very subject to disease nor very liable to suffer from the attacks of enemies. The *diseases* to which they are subject are *diarrhœa* and *dysentery*. The latter is probably only produced by neglect of the former ; at all events, we may regard the two affections as springing from the one cause.

Columella speaks of *diarrhœa* as a purging which seizes bees annually, in the spring; and conceives it to be occasioned by the bees surfeiting themselves on the young flowers in their first repast, and recommends giving them rosemary and honey diluted with water. According to others, this looseness is occasioned by the bees feeding on what is called "candied honey," which is thought to be formed by being too long in the hive, too stale, and hence sour and unfit for use. To prevent this, examine periodically the hives or boxes, and remove, on each occasion, a portion of the old or mouldy combs. The presence of candied honey in a hive is so obnoxious to bees that it frequently induces them to desert it.

The candied honey proves fatal to bees in another way beside their being poisoned by it. When the bees find candied honey in the combs, they, knowing its prejudicial qualities, if they have other and wholesome store, throw it out of the combs, and it, of course, falls on the bottom-board of the hive. They can then neither enter nor leave the hive without bedaubing themselves, and their endeavors to free themselves and their companions from the incumbrance only make matters worse. When bees are found in this state, it is difficult to relieve them; but if anything will do so, it is immersion in tepid water; for this purpose they can be swept into a tub with the wing of a fowl, leave them in the water until insensible, and unite them, when they revive a little, to the bees of another hive, taking care to serve these latter similarly. Some attribute purging and dysentery to the bees feeding on too pure honey, which is said not to be sufficiently substantial for them by itself; and the cure recommended is to give them, from another hive, combs well supplied with bee-bread or crude wax.

Enemies. — The *enemies* of bees are far more numerous than their diseases, including, as they do, poultry, mice, lizards, toads, frogs, snails, slugs, caterpillars, moths, millipedes, wood-lice, ants, lice, spiders, wasps, hornets. *Fowls* should not be permitted in any apiary. They will kill and eat the bees; and such as they do not destroy, they will annoy and disturb. *Mice* do not dare attack the hive while the bees are vigorous; but as the cold approaches, and the bees become less active, the mouse enters, and, commencing with the lower combs, ascends by degrees as the bees become torpid, until he either clears all away, or, by the smell of the honey he has wasted on the board, induces other bees to come and plunder. As soon as the warm weather returns, the surviving bees will also leave the hive in disgust. The remedy is easy. By having the straw hives, — if such are used, — coated exteriorly with Roman cement, the mice will be prevented from nestling in the straw, whence otherwise they would speedily eat their way into the interior; and, by narrowing the entrance of the hive in the manner already described, the little intruders will be effectually kept out. If the stands be placed on a single foot, or if the feet are so placed under

the foot-board as to leave a wide, projecting ledge, no mice can arrive at the hive. *Toads* will kill bees occasionally, but not in great numbers; and the same remarks are applicable to *Frogs*. *Snails* and *Slugs* are not absolutely enemies of bees, as they have no design upon them or their honey in entering the hive, but merely do so from accident. The mischief done by them consists in the alarm and confusion they occasion. The bees first attack the unfortunate intruder, and kill him with their stings; after which, they carefully encase him in propolis, effectually preventing putrefaction or the production of maggots. *Caterpillars* — especially the *wax-moths*, so called from the ravages they make amongst the combs as soon as they obtain entrance — are very injurious. By having the legs of the stand placed as has been described, no caterpillar can climb up to the hive; but this will not prevent the *moth* herself entering and depositing eggs in the hive; and so prolific are these moths, that a single brood would suffice to destroy a whole stock. Periodical fumigation, and cutting away such combs as contain the grubs, are the remedies to be adopted. *Moths* are only nocturnal enemies; during the day there is nothing to fear from their attacks. Let the entrance to the hive, therefore, be nearly closed in the evening, and the bees will be protected from their ravages. Some recommend, as a trap for moths, a bottle, or other vessel, with a long and narrow neck increasing gradually to a wide mouth, and having a light in the neck, to be placed under the hive in the evening. This will destroy numbers. Another particular to be attended to is to have the stocks sufficiently strong, and for this purpose, if the hive attacked be weak, unite to it the bees of another hive, in the manner already described. The bees are themselves, if sufficiently strong in numbers, both willing and able to destroy the intruders. If weak, they will necessarily fall victims. *Millipedes*, or *Woodlice*, are often produced by the stand being made of decayed wood, or the hive being placed too near an old hedge. Let the stand be of new wood, and strew soot on the ground under and about the hive. This will also serve in part as a protection against the attacks of *Ants*. All such ants' nests as are found in the neighborhood of a hive should be destroyed. *Lice* are small parasitical insects, of a red color, which adhere to the body of the bee, and derive their nourishment from her juices. They are about the size of a grain of mustard-seed, or rather smaller; Morocco tobacco will kill the lice, without injuring the bees. *Spiders* may be gotten rid of by brushing away their webs wherever met with near the stand. *Wasps* and *Hornets* are most noxious to bees. Dig up and destroy their nests wherever they may be met with. Among the *Birds* most inimical to bees, may be mentioned *sparrows* and *swallows*. Set traps near the hives, baited with dead bees, and hang up a few of such birds as you kill on trees near the stand.

SILK-WORMS AND MULBERRY TREES

ARE so inseparably connected, that one cannot be treated of without inviting a consideration of the other; and for this reason it has been deemed advisable to combine their description, as well as instructions regarding their culture, in one article, in preference to speaking of them separately. Up to the present time, the propagation of the silk-worm has been almost exclusively confined to the sea-board Atlantic States; and, strangely enough, the region of New England, with a comparatively rigorous climate, has been the largest as well as the most profitable producer of domestic silk. Many obstacles have hitherto retarded the silk culture in the United States, prominent among which has been the slow growth of the different species of mulberry tree, upon the leaves of which silk-worms feed. The introduction of the *morus multicaulis* promised to remove this obstacle; but the plant was made the subject of a wild speculation, which eventually ruined thousands of citizens, and retarded the silk culture to an incalculable extent. Many of the Southern and Western, as well as all of the Southwestern States, possess peculiar natural advantages for the culture of the silk-worm; and, with proper attention, this branch might, in a few years, become a profitable one in the hands of the agricultural community. Any farmer who has a family of children, or dependants, able and willing to pick mulberry leaves and take care of the worms, may safely embark in this undertaking, as the outlay will be but trifling—being comprised in the purchase of a few hundred silk-worm eggs, and an ounce of mulberry seed, or a quantity of plants.

Many persons are led to infer, from a perusal of very elaborate articles on the subject, that the business of silk culture is a very intricate and difficult one. Like every other new pursuit, it presents some obstacles to the uninitiated: but these once surmounted, it becomes as simple and easy as is the raising of cattle or poultry. During the brief existence which Nature has assigned the worm, all it requires is shelter from cold and moisture, together with an adequate supply of the proper description of feed. These wants satisfied, there can be little danger of failure; and, indeed, numbers have been eminently successful who never had any other guide than their own experience. The profits are very considerable. One acre of mulberry trees will feed 120,000 worms, from which forty pounds of silk can be obtained. Four or five intelligent children are capable of attending to this number of worms, and the period of labor does not exceed five weeks.

Description of the Silk-Worm, and of the Mode of Propagation.—One ounce of eggs will produce about 40,000 worms, which are usually hatched out in May, when the mulberry tree begins to put forth its leaves. The best eggs are those of a lustrous dark grey color, which will sink when immersed in wine. White or yellow eggs are worthless. The eggs are kept in a dry, cool situation until the proper time for hatching them arrives, when they are spread on tables in an apartment the temperature of which is raised to 80° Fahr., and in eight or ten days the worms begin to make their appearance. When they issue forth from the eggs they are nearly black, and not more than a line in length. They immediately seek for nourishment, and, if supplied with mulberry leaves, will attach themselves thereto, when they may be removed to properly-constructed frames. They generally live about fifty days, and their voracity increases with their age and growth. During their existence, they undergo four different changes, each occupying about twenty-four hours, and with each transformation exchanging their old and dark skin for one of a lighter shade. These changes are always attended by a condition of torpor, and many worms die while passing through them; but those which recover immediately eat with as much voracity as before. When the worms have successfully passed through all their moultings, they are nearly two inches in length, and of a greyish-white color. At this time their voracity is truly astonishing; the mulberry leaves disappear before them with almost incredible rapidity; and where several thousand are feeding in one room, the noise made in eating very much resembles that occasioned by the beating of a storm of sleet against panes of glass in windows. When worms are ready to spin, their bodies present a shining and somewhat transparent appearance, their appetites fail, and they eat little, but appear to be anxious, stretching out their heads in all directions, as if seeking for something. These being separated from the others, are conveyed to a place prepared with small dry branches of oak, etc. on which they ascend; each one selecting a place for itself. The worm commences its work by fastening silken threads to the branch on which it is located, and then gradually proceeds to envelop itself in them. When its living tomb is completed, it is about one inch or one inch and a half in length, and presents an egg-shaped appearance. This work occupies about seven or eight days, during the two first of which the little workman is visible; but after that time he disappears under the continued addition of fine silken threads to the interior of the walls of his cell. The worm then passes into the chrysalis state, and, if left undisturbed, will, in a few days, emerge from the cocoon in the form of a butterfly, which eats its way through the silken

walls, thus rendering them of but little value. To prevent this, all the cocoons not needed for breeding purposes, are, as soon as completed, put into an oven, and exposed to a high temperature, by which the chrysales are killed. If it is desired to reel the silk immediately, the cocoons are immersed in scalding water, which not only destroys the chrysales, but also softens the gum and frees the threads. The hardiest, brightest, and most substantial cocoons are saved for seed, strung on threads by means of a long needle, so passed through them as not to injure the occupant, and hung up in a moderately warm position. Both male and female cocoons are kept—those of the male being long and round, while the female cocoons are marked by greater size and rotundity. In fifteen or twenty days the butterflies make their appearance, and being placed on pasteboard or a woollen cloth, the female soon deposits her eggs. One hundred pairs of cocoons, weighing about a pound, will produce one ounce of seed.

Cocoonery. — For a new beginner, any spare room in a dwelling may serve the purpose, provided it can be well ventilated in mild, fair weather. A frame four feet square may be made by connecting together four posts, on which slide-rests are fixed. On alternate rests, place frames filled with meshes of catgut or twine, on which the worms may be fed, and beneath each network frame place another covered with heavy white paper, on which all the filth and excrements passing through the meshes may collect, and thence be removed without disturbing the worms. The paper frames should be placed sufficiently near to the others to enable the worms which fall through to reach the meshes, and crawl up again: this they will do in search of the leaves, with which the frames of network should always be covered. Each day's hatching should be placed on separate frames, and, during the first week the worms should be fed two or three times a day, but afterwards as fast as the leaves are consumed or become withered. The frames should be cleaned every two or three days, or even more frequently; and in hot weather the apartment should be kept airy and cool. In wet or damp weather, however, the windows must be closed, and in no case must the sun be allowed to shine on the worms. Never surfeit the worms, nor supply them with leaves covered with moisture.

Spinning and Reeling the Silk. — Many machines have been invented for this purpose, which reel and twist the silk directly from the cocoons and also manufacture it into sewing-silk. Silk is sometimes reeled while the gluten which connects together the threads is still moist, when, by uniting the filaments together as they are drawn from the cocoons, a more firm support and strong thread is produced. The machine best

adapted to the purpose is the Piedmontese reel, which is so simple as to be within the comprehension and capacity of any ordinary individual.

Casualties.—Silk-worms are subject to many casualties, besides suffering severely from want of cleanliness, cold apartments, moisture, and tempests. Large numbers are every year killed by the operation of some or all of these causes; but more disastrous than any other is the effect of thunder—the most beautiful worms, which have passed safely through all their moulting seasons, being frequently killed by the operation of electricity. Red ants are great enemies of the silk-worm, as also spiders, mice, and rats.

BOMBYX CYNTHIA, a new variety of silk-worm recently introduced into Europe from the East Indies, and naturalized in Malta, will not only eat, but thrive upon, the leaves of the Castor-Oil Plant (*Palma Christi*), and also on those of lettuce, wild endive, the weeping willow, etc. It has also the advantage of reproducing itself several times in the course of a year. The cocoon not being entirely closed, the chrysalis may enter the butterfly state, and emerge from its cell, without injuring the value of the silk; consequently the grower is not forced to sacrifice the grub in order to save the cocoon. The aperture in the latter is covered in a very novel manner. On the side from which the butterfly issues, the cocoon is terminated in the form of a cone, formed by the convergence of a crown of stiff, continuous threads, running in such a manner as to prolong that part of the cocoon, and render the entrance impassable from the outside, while it is easily traversed by the imprisoned grub, which, as it is transformed, pushes its way out, by stretching the elastic sides of this cone, the apex of which has never been closed. The stiff threads constituting the cone-shaped appendages of the cocoon are glued, doubled, and folded on each other in such a manner as to retain their primitive integrity after the hatching and flight of the butterfly. If this silk-worm were introduced into our Southern and Western States, its propagation and cultivation might be pursued with great advantage, for there the *Palma Christi* grows wild in large quantities.

GATURNIA CEANOETHA.—This is another variety of silk-worm, recently discovered in California. It is of the same species as the Chinese silk-worm, but said to be far superior. Silk of excellent quality has been produced from it.

MULBERRY TREES.—Several different varieties of the mulberry are advantageously used in feeding the silk-worm; the white (*M. alba*), (Fig. 260), which is its proper food, being extensively cultivated for that purpose; and the red (*M. rubra*) growing wild in many parts of the United

States. Both these varieties are very hardy and many-leaved, and the cocoons of the worms fed on them are extremely large. The most valu-

Fig. 260.



able tree, however, is the Chinese (*M. multicaulis*), (Fig. 261), which has been extensively and successfully cultivated in the United States. In

Fig. 261.



two years a plantation of these trees will be in full bearing from the cuttings, and will produce a larger yield of leaves to the acre than the

M. alba. It is well adapted to the climate of the United States, and in a proper soil and exposure will continue to support life during any ordinary winter; but it can only be produced by planting slips from the parent stem, as it yields seeds but sparingly, and these will frequently produce plants differing widely from the original. A hybrid variety of the mulberry has been raised in France by shaking the pollen of the moretta flowers over those of the multicaulis. The hybrid thus originated has large flat leaves, like those of the Chinese seedling, which are firm, and much relished by worms. Their powers of endurance are fully equal to those of the multicaulis, while their precocity, and the firm texture of their leaves, admirably adapt them to the silk culture.

Soil.—In order to insure a rapid increase, the soil, more especially for the multicaulis, should be a light, sandy loam, in good condition. Plants have been known to thrive well in a thoroughly cultivated clay soil, but with more or less loss of cuttings, particularly of single buds. Stony ground, unfit for general tillage, will answer equally as well as any other. A mulberry grove should, if possible, have a southern slope, and it is advantageous to have the shelter of a forest, or of high ground, on the north and west.

Culture.—The seed of the white mulberry may be sowed in drills at a convenient distance apart, and about as thickly as those of onions: cover with earth to the depth of about half an inch. The best time for sowing is during the month of April. Plant beans or potatoes between the rows, to keep the ground clear of weeds, and to yield a remuneration for the labor bestowed. The second year cut the seedlings down with a sharp knife to within three or four inches of the ground, and they will give another crop of leaves the same season. For planting out, the hedge form is the best; setting the young trees eighteen inches apart. Cuttings should be taken from the growth of the previous summer, and be from six to twelve inches long. They should be planted in rows nine inches apart, with eighteen inches between the rows; soaked twenty-four hours before planting; and well watered in dry weather. The slips should be planted in a slanting position, with the buds uppermost. The white mulberry has the advantage of being clothed with leaves fifteen or twenty days in advance of the earliest of the other varieties; but no leaves should be gathered from the white mulberry until after the fourth year, as it will injure the growth and constitution of the tree. When required for a hedge, the plants may be set out when one or two years old. Cut them down the first year to within four or six inches of the ground, only leaving two buds; and, after another

year's growth, one of the new sprouts may be laid down in the line of the fence, and tied to the next plant; the others being left to grow upright. The buds from the laid sprout will send up shoots, and fill up all the intervals. Sprouts springing from the roots should be cut away, unless wanted for layers. The plants may be set out about fifteen inches apart. The *Morus Multicaulis*, thus named on account of its tendency to throw out many stems from the same root, may be most certainly increased by layering the leaves in slight trenches about five or six feet apart, and covering them with fine-sifted earth. They should first be deprived of part of their side branches, and the ground should have sufficient warmth to start the buds immediately, or many will perish. Cover the root deeper than the stem; hand weed, hoe, and plough the ground, so as to keep it open, and free from weeds. When the plants are about twelve inches high, it will be advantageous to draw the earth around the stems. The green branches may be layered without separating them from the tree; and, by removing the terminal bud, many small plants will be produced. Unripe wood, the growth of the same season, may also be used for cuttings, and in good soil, with careful shading and proper cultivation, will make thrifty plants. Single bud cuttings more frequently fail from irregularity in the seasons than do those of greater length, which commonly germinate more than one bud each. The *multicaulis* possesses, more largely than the other varieties, the desirable property of throwing up numerous small pliant stalks, without forming a main stem; of producing a rapid growth of tender leaves, which are speedily renewed; and of quickly striking root from cuttings of the stalks and branches. By heading the stalks down nearly to the ground every year, a rich growth is produced; and it is comparatively easy to multiply them *ad infinitum* from the roots or cuttings; yet, although so readily increased, they require great care and attention in hand-weeding and stirring the earth; and the farmer who thinks he has accomplished everything by merely placing them in the ground, will, in the autumn, discover that his trees have suffered so much for want of attention, as to seriously retard their growth. By transplanting the trees, and setting them out in rows ten feet distant from tree to tree, with proper care and culture, five times the amount may be raised from an acre.

If it is desirable to conduct the business on an extensive scale, a choice may be made between three modes of planting the *Morus Multicaulis*, viz.: that of standards, in fields on which farm crops are raised; of half-standards, in grounds devoted to that purpose; and of dwarf hedge-plants, for field divisions, etc. For standards, the trees may be planted

at such distance apart as may be determined upon, never allowing it to be less than ten or fifteen feet; but half-standards will only require a separation of from three to seven feet. Before planting in the latter mode, the ground should be well trench-ploughed, the soil finely pulverized, and thoroughly manured, when the sets may be put in the rows in quincunx form; that is, each tree opposite the space between two of the next row. A space of four feet being left between each row, there will, of course, be some vacant ground, which may be profitably cropped with potatoes or beans, the tillage of which will greatly facilitate the growth of the trees. Half-standards may be taken from the nursery at two years old, and, if very thrifty, at one year; they will require no pruning, except where limbs trail toward the ground, and should always be transplanted in the spring of the year. Hedge-planting may be conducted in the same way as previously indicated for the white mulberry.

CHAPTER X.

FLOWERS, ORNAMENTAL AND USEFUL TREES, ETC.

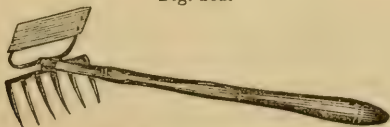
THE CULTURE OF FLOWERS—PLANS FOR FLOWER-GARDENS—DESCRIPTION OF
STANDARD VARIETIES OF FLOWERS—ORNAMENTAL SHRUBS—ORNAMENTAL
AND USEFUL TREES—MONTHLY FLORICULTURAL CALENDAR.

I. FLOWERS.

General Remarks.—The pre-requisites of flower-beds and composts are, depth, friability, and necessary richness. The practice of trenching the sites of flower-beds to the depth of three feet is found to be of great service; not that any of the fibrous roots can reach so low, but because the bed should be quickly drained after much rain, and that in dry weather the roots may be invited to run as deep as they have a tendency to go. There is another reason for deep trenching, which is, no doubt, as beneficial to flowers as it is to all other plants, viz., they receive a greater share of that genial moist warmth which is at all times rising from the interior of the earth to its surface. This is a circumstance not enough attended to, and by many practitioners is quite unheeded; it is, nevertheless, a great assistant to vegetation. According as we descend, the temperature increases. In the winter and spring months it is by several degrees warmer at the depth of a few feet than at or near the surface. The ground being opened to that depth, therefore, permits the ascent of this warm steam in cold weather, and allows it to rise like a refreshing vapor, when the weather is hot and dry; in both seasons of much advantage to the roots.

Friability.—That flowers may have every encouragement from the constitutional texture of the compost they are placed on, it is prepared by being compounded, aerated, and screened, till it is free from stones, clods, &c.,

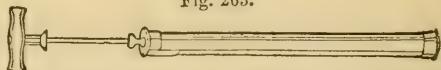
Fig. 262.



and all of a uniform consistence. It should not be liable to knead in working, nor run together under heavy rain. By the addition of sand, rotten

dung, or leaf-mould, it must be sufficiently porous to receive, and as readily discharge, any excess of water, as well as allow the penetration of every quality from the air which is beneficial to plants. A garden syringe, like the following, will be found very convenient in applying water to flower-plants.

Fig. 263.



Enriching. — The high fertility of the soil intended for flowers is one of the principal provisions to be made for their prosperity. In the compost every ingredient should be present that experience has discovered to be useful, and every quality added which successful practice sanctions, or what rational ingenuity may suggest. The luxuriance of the plants depends on the suitableness and temperament of the compost; and the richness of the tints depends on the qualities contained in it.

Coverings, &c. — For the defence of fine bed-flowers from inclement weather, and to preserve them in beauty as long as possible, the florist who wishes to excel in the art, and derive the utmost satisfaction from the pursuit, should provide himself with every necessary appendage for the purpose. The means of temporary protection against rain, hail, or snow, and awnings for the preservation of the full-blown flowers, are both necessary.

Stages, as well as beds, require these appurtenances. Few lovers of flowers, who take delight in their cultivation, can grudge the expense of proper means for both shade and shelter. Commercial florists have arrangements for these purposes on an extensive scale, embracing all the advantages of convenience and utility; the amateur, or flower-fancier, adopts as many of these conveniences as are sufficient for his more limited designs.

For all bed-flowers, particularly hyacinths and tulips, the beds should be surrounded by boarding from one to three feet high, to give, for ease of examination, the necessary elevation to the flowers. Staples driven in at the corners and along the sides of this boarding serve to admit wooden or iron hoops, which, connected along the centre and at the eaves with slight laths, form a sufficiently firm and effective frame to bear any covering of mats or canvas.

Carnation stages are either single or double, — that is, having one or both sides composed of graduated shelves. In the one case, a walk in front is sufficient; in the other, the walk is carried all around. Those for auriculas are similar, both being raised on feet, each of which stands in pans of water, to prevent the visits of creeping insects.

When the foliage of the plants has advanced so far as to be in jeopardy from frost, &c., the hoops are placed, and the coverings got ready to be

employed as the weather directs. Tulips are, much more than others, liable to be injured, especially during the months of February, March, and April. They are then most easily damaged by the operations of the weather, or by water resting near, and afterwards freezing around the bud; and, though every care should be bestowed to protect the plants from such casualties, yet they must not be deprived of the full air too long a time, as this would injure by enfeebling them. So much is over-covering to be guarded against, that some intelligent cultivators use only small-meshed nets as a defence, which are considered sufficient.

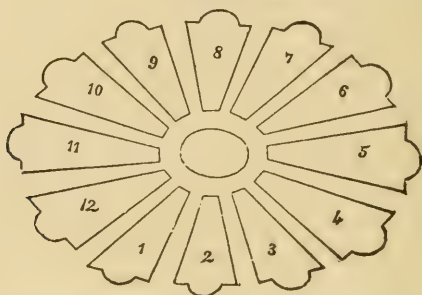
When the flowers begin to show color, preparations must be made to erect the awning. This is intended to shade them from a severe sun, and shelter them from tempest winds. The frame should be as light in its construction as is consistent with its stability against windy weather. It is either a permanent erection of slender columns, eaves-plate, rafters, and ridge-board, or a temporary framing of similar scantlings, screw-bolted together for the purpose. The latter are preferred by private growers. No directions need be given for a permanent structure, that any common carpenter can supply and execute. But for those who only need a temporary thing of the kind, the following description of a very suitable and convenient one may be useful: The bed is surrounded by a fine gravel or sand walk, two and a half feet wide; on the outside of the walk, oaken trunks, sixteen inches long, having central openings two inches square, are sunk and firmly rammed in the ground, their tops level therewith. These trunks have each a capped stopper, to be put in when the frame is taken away; they remaining always in their places, and serve as sockets to receive light columns six feet high, turned out of three-inch-square stuff, having a two-inch-square tenon to fit into the trunk, and also a smaller tenon at top, to pass through the eaves-plate, and also receive the foot of the rafter which rests upon it. The rafters meet on a ridge-board, to which they are fastened by a screw-bolt and nut. Besides the corner columns, intermediate ones are added, according as the length of the bed requires. The canvas for the roof is in one piece, fixed by its middle to the ridge-board, the two sides being movable on rollers or otherwise, and rolled up or let down at pleasure. The ends and sides are closed by curtains, and hung on headed studs driven into the end-rafters and eaves-plate, by eyelet-holes worked in the upper leech of the curtains: at the bottom they are fastened down by tender-hooks or ties. Such a frame and awning, if care be taken to lay it up dry in a spare room, will last for many years, and, when in use, may be made, by ornaments fixed at the ends of the ridge and at the tops of the columns, not at all an unsightly object, even in the flower-garden.

Plan of a Flower-garden.—Supposing the soil to have been in all

respects duly prepared, dug over and leveled, the next thing is to determine upon the plan for the garden. It should certainly be a regular geometric figure, and planted in masses, each bed containing flowers of one kind, so as to produce something of the fine effect of a Turkey carpet when looked down upon.

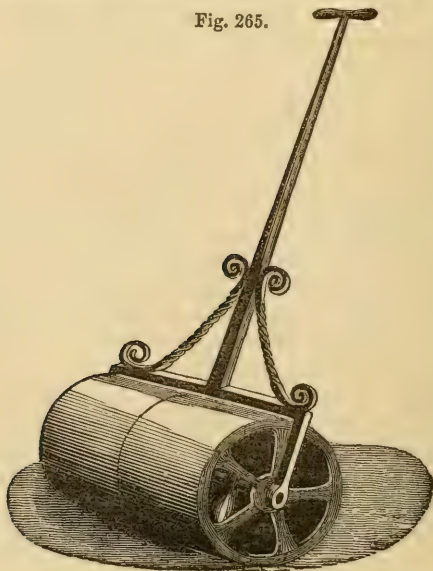
We will suppose the plan (Fig. 264) to consist of twelve flower-beds on grass, with a gravel-walk around, which may be bordered on one side by

Fig. 264.



beds of flowers, with little gravel openings, or be plain gravel, as may be

Fig. 265.



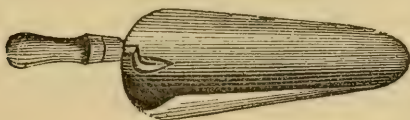
preferred. The walks should be smoothed and hardened by means of a garden roller. There may be a conservatory into which the parlor-room windows facing the south may open, and on the other side there should be a shrubbery to unite it with the lawn. In the centre of the flower-garden there may be a fountain. As the flower-garden is to be seen principally from the dwelling-house windows, the nearest beds should be planted with dwarf-flowers, so that those in the back beds may be seen; the shrubbery behind to consist of *laurustinus* and *arbutus*, so as to afford a handsome green background to the flowers in summer, and yet afford a few flowers themselves in winter and spring, when flowers are scarce in the beds. When the walks are bordered with grass, an implement like the following, fitted to a straight handle, is used for paring the edges.

Fig. 266.



Planting.—Get a few pots of Californian and other annuals usually raised in pots, and plant them, putting three potfuls in each bed. In No. 1,

Fig. 267.



put *Phlox Drummondii*, the flowers of which are crimson of various shades, and let the stems be pegged down, so as to spread over the bed. No. 2 may be *Lasthènia Californica*, the flowers of which are yellow, and the stems generally procumbent; but they may be pegged down to keep them in their proper places, that is, to spread completely and regularly over the bed. No. 3 should be *Nemóphila insignis*, the flowers of which are of a beautiful blue, and which will not require pegging down. No. 4 may be *Erysimum Petrowskiànum*, the flowers of which are of a bright orange; but the stems must be pegged down, or they will grow tall and straggling. No. 5 may be *Nolana atriplicifolia*, the flowers of which are blue, and

resemble those of a convolvulus; this is a procumbent plant, and will not need pegging. No. 6 may be *Nemóphila atomària*, which has white flowers, and is a dwarf plant. No. 7 may be *Leptosiphon densiflorus*, a dwarf plant, with pale purple flowers. No. 8 may be *Gilia bicolor*, a dwarf plant, with nearly white flowers. No. 9 may be *Gilia tricolor*, a dwarf plant, the flowers of which are white and very dark purple. No. 11 may be *Leptosiphon androsæus*, a dwarf plant, with pale lilac flowers. And No. 12, *Schizopétalon Walkeri*, the flowers of which are white, and the stems must be pegged down. These are all annuals, which, if properly treated by pegging down, and not planted too close, will produce a mass of flowers in each bed only just above the surface of the ground, and will have a charming effect from the windows. Most of them like a poor, clayey soil best, and they will only require turning out of the pots, without breaking the ball, into the places prepared for them. If it is thought there are too many white beds, substitute *Sanvitalia procumbens*, the flowers of which are yellow, for No. 8, — but the seeds must have been sown the previous autumn to bring it forward, as otherwise it will not flower till late in the summer; and *Bartonia aurea*, the flowers of which are of a golden yellow, may be planted instead of No. 12. *Cladanthus arabeus*, formerly called *Anthemis arabica*, which has yellow flowers, may be planted in No. 8, if *Sanvitalia* cannot be obtained. Florists, however, can generally furnish these sorts.

Autumnal Flowers. — As most of the annuals will begin to look shabby in July or the early part of August, we give the following list of half-hardy plants for autumn: No. 1, *Verbena Melindres*, bright scarlet; No. 2, *Enothera Drummondii*, yellow; No. 3, *Lobelia bicolor*, blue; No. 4, *Calceolaria rugosa*, pegged down; No. 5, *Verbena Tweediana*, crimson; No. 6, common White *Petunia*; No. 7, *Verbena Arraniana*, or Henderson's purple; No. 8, *Calceolaria integrifolia*, yellow; No. 9, Purple *Petunia*; No. 10, *Verbena tenerioides*, white; No. 11, *Frogmore Pelargonium*, bright scarlet; No. 12, Musk plant, yellow.

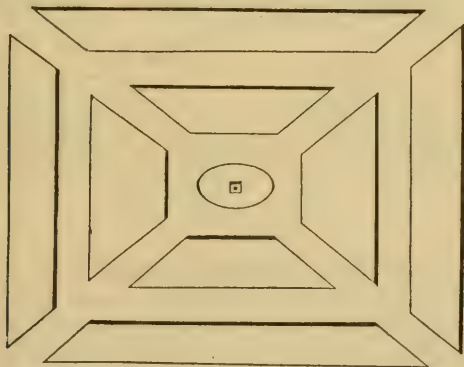
In October the following bulbs and other plants may be put in for flowering in early spring. No. 1, Van Thon tulips; No. 2, Cloth of gold, or common yellow crocuses; No. 3, Blue hepatica; No. 4, Yellow crocuses, or White Anemone; No. 5, *Scilla verna* and *sibirica*, blue; No. 6, *Arabis albida*, white; No. 7, Double pink hepatica; No. 8, Winter aconite; No. 9, Purple crocuses; No. 10, Snowdrops; No. 11, Primroses; No. 12, White hepatica, or *Arabis alpina*.

Laying out the Flower-garden. — If the above plan for a garden does not meet the fancy, one can be drawn of any figure desired. In the first place, the ground must be dug over, raked, and made perfectly smooth. The pattern, if a complicated one, should then be drawn on paper, covered with

regular squares, and the ground to be laid out must be covered with similar squares, but larger, the usual proportion being that a square inch on the paper represents a square foot on the ground. The squares on the ground are usually formed by sticking in wooden pegs at regular distances, and fastening strings from peg to peg, till the whole ground is covered with a kind of lattice-work of string. Each string is then chalked, and made to thrill by pulling it up sharply and letting it go again, which transfers the chalk from the string to the ground. When the ground is thus marked with white squares, it is easy to trace upon it, with a sharp-pointed stick, any pattern which may have been drawn on the paper; the portion in each square on the ground being copied on a larger scale from that on the paper.

Simple patterns, like that of the following figure, consisting of straight lines, need only to be measured, and pieces of string stretched from pegs put

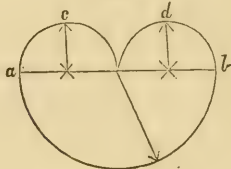
Fig. 268.



in at the proper distances, so as to form straight lines, oblongs, squares, triangles, or diamonds. If a circle is to be traced, it is done by getting a piece of string half the length of the diameter of the circle, with a piece of stick tied to each end. One stick is then driven into the ground in the centre of the circle, and a line is traced with the stick at the other extremity of the string, which is drawn out quite tight. An oval is made by tracing two circles, the circumscribing line of one of which just touches the centre of the other; short lines are afterwards made at the top and bottom, and the central lines are obliterated. A square only requires a peg at each corner, with a chalked string drawn from peg to peg; and an oblong, or parallelogram, is made by joining two common squares, and taking off the corners, if required. A heart-shaped pattern is made by drawing a straight line from

a to b (Fig. 268), and then fixing a peg with a string tied to it half the length of the straight line, and another peg at the end, exactly in the middle

Fig. 269.

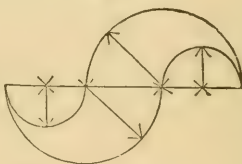


of the line, and drawing half a circle with it; then taking a peg with a string half the length of the other, and another peg to the end, and tracing with it the smaller half circles, c and d . With the same strings and pegs you may easily trace, or have traced, the following figures. Even the latter, which

Fig. 270.



Fig. 271.



appears at first sight a very difficult figure to form on the ground, will be just as easily traced as the others. It will be observed that in all these figures the straight line is only to serve as a guide to show the proper places for fixing the pegs; and that it is only to be formed by a piece of string stretched by pegs from one end of the figure to the other, which is to be removed as soon as the figure is sketched, and which is not to be traced on the ground at all.

With the aid of these figures, and the pegs and strings, several very complicated gardens may be formed; for instance, that shown in the following outline. This garden is composed of a bed in the centre for a tree-rose, with a circle of dwarf-roses; a gravel-walk surrounds these; and there are five heart-shaped beds, which may be planted with scarlet pelargoniums, yellow calceolarias, petunias white and purple, and tall yellow mimulus; and the crescent-shaped beds which are on grass may all be planted with different kinds of verbenas. This plan is also a good design for a rosery, — the roses to be planted in the beds, and in the

half-crescents, which must be on grass, with gravel-walks between the grass-plots.

All the beds intended for bulbs and half-hardy plants should be particularly well drained; and the best way of doing this is to dig out the soil to the depth of two feet or more, and then put in a layer of brick-bats and other rubbish, to the depth of nine inches or a foot. On this may be placed a

Fig. 272.



layer of rich, marly soil, in which the bulbs are to be planted. Dahlias, hollyhocks, and other tall-growing, showy-flowered plants, should have similar beds prepared for them; but the soil should be made very rich by the addition of the remains of an old hot-bed, or some other kind of half-rotten animal manure.

Arrangement of Colors. — In the directions which have now been given for planning and planting the beds, it has been intended merely to say what may be done, and not what is absolutely necessary. Indeed, it will be better for each cultivator to vary the flowers as much as possible, according to taste, provided care is taken that the plants are, as nearly as possible, of the same height, or that they rise gradually, and that the colors contrast well. The rule in the latter case is, always to put one of the primitive colors—red, blue, and yellow—next another of these colors, or some color compounded of the other two, using white wherever you cannot find any handsome plants of a color that will suit the bed for which they are wanted. Thus, for example,

if one bed be planted with red, the next may be planted with blue, yellow, green, hair-brown, or white, but never with any shade of purple, as red enters into the composition of that color; nor with any shade of reddish-brown; purple, indeed, must always be next to yellow, hair-brown or white, but never next blue, red-brown, or red. Orange will not look well near yellow or red, and lilac must not approach blue or pink. A little practice will generally do more than any lengthened details. Generally speaking, you may take the same taste to guide the arrangement of the colors of the flowers in the parterre that is used in choosing the colors of female dress.

Fragrant Flowers. — When it is settled what to plant in the beds of the garden, — supposing the plan of Fig. 264 to be chosen, — the next thing to be thought of is the beds around it. These should, on the whole, remain unplanted, unless they are sown with mignonette, or something of that kind. The shrubberies should consist chiefly of the finer kinds of hardy evergreens, — at least, that which is opposite the windows of the house; — the other shrubbery may be planted with rhododendrons, acacias, and kalmias, — the rhododendrons being furthest from the walk, and carried a little out into the adjoining grounds, so as to make a broken line, projecting in some places and receding in others, and here and there mixed with bushes of phillyrea, alaternus, holly of various kinds, and cræægus. With regard to the beds near the house, let there be a *Lonicera flexuosa* trained over each window, on account of its delightful fragrance in summer. For a similar reason, have *chimonanthus fragrans* against the walls between the windows, and mignonettes and violets in the beds. The flowers of the evergreen magnolia, and those of the orange, have a slightly oppressive fragrance, as have those of the heliotrope and the tuberose; but those of the mignonette, the lemon-scented verbena, the rose, the violet, and *Lonicera flexuosa*, are refreshing, at the same time yielding delicious perfume.

Cultivating Bulbs. — In giving some hints on the cultivation of flowers, we begin with the *bulbs*, as they flower first in the spring. The crocuses and snow-drops should be planted, five or six together, as close as possible, so as to form little tufts; and these, when once planted, should never be removed, unless they should grow out of bounds, so as to spoil the shape of the bed. The tulips, on the contrary, should be taken up as soon as their leaves begin to decay, and kept in a dry place till the proper time for planting them next year.

There are three kinds of plants which are said to have bulbous roots, — those which are solid, and which should be properly called *corms*, — such as the crocus, the corn-flag, and many of the half-hardy plants with similar

half-tubular flowers ; the tunicated bulbs, which may be peeled off in scales, such as the onion, the hyacinth, and the tulip ; and the scaly bulbs, such as the lily. Now, the real roots of all these plants are the long fibres sent down by the lower part of the bulb, which may be seen plainly in hyacinths grown in glasses, and in any of the kinds, if taken up while in a growing state ; and what is called the bulb is, in all the corms, only a contracted stem ; but, in the tunicated and scaly bulbs, the bulbous part is formed of a contracted stem and metamorphosed leaves. On examining a hyacinth, there will be found at the base of the bulb a flat, fleshy substance, called the root-plate, and this is, in fact, the contracted stem of the plant ; while the tunics or scales are metamorphosed leaves. It will be useful to remember these distinctions in cultivating the garden, as all plants having corms never flower well till they have been allowed to form a mass, which they will not do till they have been in the ground three or four years. Many persons fancy that the Cape bulbs require to be taken up every year, but this is a mistake ; all the kinds of gladiolus, ixia, tritonia, and other similar plants, will live in the open ground, and flower well, if suffered to grow in masses, and be warmly covered in winter. Some persons practise successfully the plan of manuring the beds of tulips and hyacinths every year, so that they may be grown together in the same beds without taking up, for several years in succession.

Reserve Garden Spot. — It is well, in order to keep the flower-garden in a proper state, to have what may be called a reserved plot of ground, in which the plants are to be brought forward, till they are in a proper state for transplanting into the proper flower-garden. This reserve garden is generally placed near the stable, both to have it out of sight and for the convenience of manure, as it must contain hot-beds and frames, for rearing tender annuals, striking cuttings, and, in short, for performing all those gardening operations which require to be carried on out of sight. In this spot the Californian annuals are to be brought forward.

Choose a piece of hard ground, — a walk will do, — or any place that has been much trodden on, and cover it about an inch thick with light, rich soil. In this the seeds of the annuals should be sown in September, and suffered to remain till the bulbs have faded, and the annuals are wanted to cover the beds, which will probably be about April. The annuals must then be taken up with the spade, in patches, and being removed to the flower-garden, they must be laid carefully on the beds, so as to cover them exactly ; — the spaces between the patches being filled with soil, and pressed gently down, so that the surface of the beds may be as even as possible. These annuals will come into blossom in May, but they are killed by the dry heat of summer ; and, though they would sow themselves if per-

mitted to seed, it is better to remove them as soon as they have done flowering. The worst of permitting plants to sow themselves is, that early in autumn the flower-beds will have a very untidy appearance, as the ground not only becomes rough, but it is covered with dead stalks and leaves, which have always a most desolate appearance; and these cannot be removed till the seed has fallen, while the beds must not be forked over and raked, for fear of destroying the seedlings. It is, therefore, much better, as soon as the annuals have done flowering, to take them up and throw them away, — a supply of seed being preserved by having left some plants in the reserve-ground for that purpose. A second or spring sowing of the Californian annuals may be made in the reserve-ground, for use, if needed, in the autumn.

Culture of Annuals. — Annuals are plants that live only one year, or, rather, only a few months, for they are generally sown early in spring, and die as soon as they have ripened their seeds, at the latter end of summer, or the beginning of autumn. These plants are of three kinds, — hardy, half-hardy, and tender.

The *hardy* annuals are sown in March, April, or May, but the second month is to be preferred, if the weather is tolerably open. The ground in which they are to be sown is then forked over and raked, and a little round, firm place is made by pressing the bottom of the saucer of a flower-pot on the ground, and then scattering a few seeds on the firm place, taking great care that the seeds do not lie one upon another. The seeds are then firmed, as the gardeners call it, by pressing the saucer again on them, and some earth is strewed lightly over to finish the operation. Instead of the saucer of a flower-pot, regular gardeners perform that part of the process with their spades. The idea is, to securely fix every seed in the ground before it begins to germinate, in order to produce a strong and healthy plant. After the seeds are sown, it is customary to put a piece of stick into the ground, with the name of the seeds written upon it, to mark the place; or, if preferred, write the name on a card, or a bit of pasteboard, and stick it in a notch or cleft made in the stick.

When the seeds have come up, — which, in the spring, is generally from a fortnight to six weeks after sowing, according to their natures, — the seedlings may be thinned out, and the supernumerary plants either transplanted or thrown away. If the seedlings are to be transplanted, care should be taken not to break or injure the roots, and a little hole should be made with a stick for each seedling in the place to which it is to be removed; the earth being pressed close to the root at the bottom of the hole before the rest of the hole is filled in, as, if any hollow place is left around the root, it will decay, instead of growing. Seedling hardy annuals are,

however, very seldom worth the trouble of transplanting. Many persons turn a flower-pot over every patch of seeds, from the idea that it will make them come up sooner, and protect them from birds. It is, however, a bad plan, as air and light are particularly necessary to seedling plants, and, when they are even partially deprived of these important agents, they become drawn up, with weak, slender stems, and thin, discolored leaves.

Some annuals, such as the mignonette and the larkspur, are much longer before they vegetate than others, and they are better sown in autumn. Others, such as the *Erysimum Perowskianum*, the *eschscholtzia*, and the *coreopsis*, will often last two or three years, especially if they happen to be late in flowering the first season. These also do best sown in autumn; but they must be protected, if the winter should be severe, by laying a mat over the bed.

Half-hardy Annuals. — The half-hardy annuals, such as the French and African marigolds, the Chinese and German asters, the zinnias, the purple *jacobæa*, the sweet sultan, the purple and yellow everlastings, and other similar plants, may be sown in pots, and plunged into a slight hot-bed in February or March. As soon as they come up, and have got their second pair of leaves, the earth should be turned out of the pots, and the seedlings, being carefully picked out, should be transplanted into other pots, three or five in each, according to the size they are expected to attain when full grown, and the pots again plunged into the hot-bed. Sometimes they are transplanted a second time; but they are generally left till May, when they are removed to the open border, to the places where they are intended to flower. When they are planted in the border, they may be transplanted in the ordinary way, or the ball of earth may be turned entire from the pot into a hole made to receive it. This is generally considered the best plan, as it prevents the plants from receiving any check by their removal. Brompton, ten-week, and German stocks, though quite hardy, make better plants when treated like half-hardy annuals, as they flower earlier and more vigorously.

Tender Annuals. — The tender annuals, such as balsams, cock's combs, globe amaranths, &c., must be sown in February or March, in pots of light, rich earth, and plunged in a hot-bed. As soon as the plants come up, they should be transplanted into pots of the very smallest size, one in each pot: and these small pots should be set in the hot-bed again, as near the glass as possible, and slightly shaded during sunshine. In a week or two, as soon as the roots have made their appearance on the outside of the ball of earth within the pot, — which is known by turning the ball of earth, with the plant in it, carefully out of the pot, without breaking it, — the plants are shifted into pots a size larger than what they were in before, and the space filled up

with light, rich soil. In another week or two the plants must be shifted again into pots a little larger, always using light, rich mould to fill up the pots, and taking care that the pots are well drained, by putting pieces of broken pot at the bottom. As soon as the plants are shifted, the pots must be replunged in the hot-bed, and shaded for the remainder of the day. The shifting and replunging must be continued till the plants begin to show flower-buds, after which they must neither be shifted nor plunged in the hot-bed any more, but gradually hardened, by the frame in which they are placed being left open all day, and, at last, only partially closed, even at night, till the plants will bear setting out entirely in the open air, unless they should be intended to flower in a green-house, in which case they may be removed to the green-house very soon after they have shown flower-buds.

Perennials.—Perennials are those permanent plants which are not woody, and yet remain in the ground as long as most kinds of shrubs, producing flowers and seeds every year. Perennials are of two kinds,—those that die down to the ground every autumn, and send up fresh stems from the root the following spring,—and those which remain green all the year, as, for example, those that have tuberous roots, such as the dahlia. Bulbs are also perennials; but of these we have already spoken.

Most kinds of perennials are propagated by dividing the roots; but, in the case of the dahlia, ranunculus, and anemone, care must be taken to choose only those portions of the tubers that have buds or eyes, as they are called, as otherwise the tuber, though it will send out fibrous roots, will not produce a stem; and, in dividing fibrous-rooted plants, care must be taken that the divided part is furnished with buds. Almost all kinds of perennials may also be propagated by cuttings; and those of pinks and carnations are called pipings, because, instead of being cut, they are pulled asunder at a joint, and this gives the separated parts a hollow appearance, like small pipes. Tubers are frequently taken up every autumn, and those of the ranunculus and anemone are replanted in November or January, the former season being rather preferable. The tubers of the dahlia are generally taken up in November, and replanted in May or June.

Most perennials are improved by taking up occasionally, and replanting them in another place. This used to be accounted for by supposing that plants threw out excrementitious matter, which, after a few years, poisoned the soil in which they grew; but it is now supposed that, as every plant requires peculiar earths for its nourishment, they must be removed when they have exhausted all the particular kind of earth they want which grows within their reach. It is rather difficult to explain this without entering into long details; but it will be sufficient for our present purpose merely to state the fact that plants do require their roots to have a constant supply of

fresh earth and, to meet this want, nature has provided that the roots of trees, and of all plants that are intended to remain several years in the soil, elongate themselves every year, so as to be continually able to obtain a fresh supply of nourishment. In gardens, however, the constant digging that is going on for the culture of annual plants is unfavorable to the elongation of the roots of the perennials, and consequently it is absolutely necessary that those plants should occasionally be taken up and replanted. The season for taking up and replanting perennial plants is either in autumn, after they have done growing, or in spring, before they begin to shoot; and, if the soil about the roots looks black and wet, or, as the gardeners express it, sour, the roots should be washed quite clean before transplanting. When the roots of plants are divided, it is either done with a sharp spade or a knife, care being taken, in both cases, to make a clean cut, and not leave any part bruised or jagged.

Biennials. — These are plants raised from seeds, which do not flower till the second year, but which generally die as soon as they have ripened their seeds. Biennials are usually sown in a bed of light, rich earth, in the open year in the reserve ground, and then transplanted, in September, to the place where they are to flower the ensuing year. The finer kinds, such as the Brompton stocks and hollyhocks, should have a bed or pit prepared for them, of rich, loamy soil, in which they are planted, with a small quantity of manure. Wall-flowers, snap-dragons, and Canterbury bells, do not require any further care than transplanting to the border; and, though they are called biennials, they will frequently live and flower for a succession of years.

The Hot-bed. — A hot-bed may be made of any material that will ferment, so as to produce heat. Stable manure and dead leaves are, however, generally preferred to all other materials, and stable manure is unquestionably the best. A cart-load of this manure will make a hot-bed sufficiently large for rearing tender annuals; and when it is taken out of the stable, it consists partly of the dung of the horse, and partly of what is called long litter, — that is, straw moistened and discolored, but not decayed. When in this state, if it is thrown together so as to form a heap, a most violent heat is produced by the fermentation of the straw while decomposing, and, as this heat would be too powerful for any plant exposed to it, it is necessary to let the heap remain for a fortnight or so, turning it over two or three times, during that period, with a fork, till the straw is sufficiently decomposed to be easily torn to pieces with the dung-fork. When the manure is in this state, it is fit to be used. The hot-bed should be formed in an open situation, on a surface raised about six inches from the surrounding ground, with a gutter or shallow ditch cut around it, to allow the water to drain off. The bed

is then made, and, if only intended for raising annuals and striking cuttings, it may be five feet long by four feet wide. The manure should be regularly spread over the lower part of the bed, and in successive layers, made as smooth and level as possible, till the whole of the cart-load of manure has been used.

As soon as the bed is finished the frame should be set on it. The frame consists of a box without a bottom, and with a movable top, formed of a glazed sash or sashes. A frame for such a bed as has been mentioned will only require one sash or light; and it should be three feet wide and four feet long, so that the bed may be half a foot larger than the frame on every side. The back of the box may be two feet high, and the front one foot, so that the glass may slope from the back to the front. About two days after the bed is made, the fermentation will recommence, and a steam will be observable on the glass. The surface of the bed should now be covered, two or three inches thick, with light garden mould, and any common seeds may be sown in this. It is more general, however, to sow the seeds in pots, and then either to set them on the surface of the bed, or to plunge them into it up to the rim. No bed for raising annuals should ever be hotter than 60° ; and when it exceeds this heat, the glasses should be left open so as to cool it. The thermometer for ascertaining the heat should be put on the surface of the bed, with the glass shut above it; and it should be examined in this situation, as it will fall a degree or two immediately on being taken into the open air, if the weather should be very cold.

A hot-bed of two or three lights will require two or three cart-loads of manure, and will, of course, produce a great deal of heat, from the immense mass of fermenting materials it contains; and, unless properly regulated, the plants will turn black, and the leaves be shriveled up, or, as the gardeners term it, burnt, from the too great heat of the bed. There is also danger of a hot-bed getting too cold, instead of being too hot; and, when this is the case, the heat should be renewed by the application of dung-linings, that is, a quantity of fresh stable manure around the outside of the bed. Linings are sometimes made of dead leaves piled up around the outside of the bed; but, if the hot-beds are to be used only for raising seeds, they will not want any linings, as it will be advantageous for the young seedlings if the beds are allowed gradually to become cool as the plants increase in size, so that they may acquire strength and hardiness before they are turned into the open ground.

Green-house Plants. — A few words on the green-house plants that will be wanted for planting in the open ground in the flower-garden may not be amiss. Petunias may be all raised from seeds with the other half-hardy annuals, as seedling plants both grow and flower much more vigorously

when planted out into the open ground, than plants that have been raised from layers or cuttings. *Celsia* or *Alonsoa urticifolia* may also be raised from seeds, as may *Thunbergia alata*, and its white variety. *Phlox Drummondii* is almost always raised in this manner, as are the beautiful climbing plants, *Lophospermum scandens* and its varieties, *Maurandya Barclayana*, *Cobæa scandens*, *Eccremocarpus* or *Calampelis scabra*, *Rhodochiton volubile*, the beautiful canary-bird flower (*Tropæolum peregrinum*), the most splendid of the ipomæas, and several other well-known plants.

Geraniums, or pelargoniums, as they are called, being half-shrubby plants, require to be raised by cuttings. These are generally taken off the points of the shoots in autumn, and, a good many being put into one pot, they are plunged into the hot-bed till they have struck root, and then gradually hardened and placed on the back shelf of a green-house, or in a cold frame, till the spring, when they are removed to separate pots till they are wanted for planting out. Some gardeners do not put themselves to the trouble of potting them, but keep them in the same pots in which the cuttings were struck till they are wanted for planting out; but this is an indifferent mode of culture, as, when the plants are kept so long in one pot, they become drawn up, and do not have the compact, bushy appearance that they have when properly transplanted early in spring. Verbenas may be either preserved by cuttings or layers, or raised afresh from seed. The usual way of propagating them, however, is by layers, as they strike root readily at the joints, if the joints are covered with a little earth. All the other green-house plants which are wanted to grow for planting out may be treated in the same manner as those which have been mentioned.

Cold Frame. — This is a bottomless box of the kind described for a hot-bed, but formed of brick or stone, instead of wood. These frames have a glass sash at the top, but contain no manure; and they are generally sunk in the soil, that the warmth of the soil around may aid in protecting the plants they contain from the frost. These frames, if they have only one light, are generally five feet in width, that is, from the back to the front; but, if they have two or three lights, the width is generally seven feet, as these are the dimensions of the frames used for hot-beds in kitchen-gardens. The green-house plants that are to be preserved in the cold frame are merely set in their pots close together, and, the glass sashes being then closed, mats and other coverings are laid on to keep out the frost.

Sometimes green-house plants which are left in the open ground are preserved from the frost by coverings of wicker-work, like bee-hives, being put over them, or tin hoops over which mats have been stretched; or, where the plants are small, a flower-pot may be turned over them, or a hand-glass used for the same purpose. It is seldom, however, worth while to take

much pains to preserve green-house plants that have flowered in the open air. The ordinary way is to make abundance of cuttings in autumn ; to strike them in a hot-bed, and then, after hardening them by degrees, to preserve them in a small green-house, or in a cold pit, till the time for planting out next year.

Winter Management. — Many persons injure green-house plants by keeping them too warm and giving them too little air during winter, and then are surprised that their plants become sickly and remain without flowering, notwithstanding all the care and expense that have been bestowed upon them. No green-house ought to be kept at a greater heat, during night, than from 35° to 40° ; and in the day-time it should not be allowed to rise above 50° , or at most 52° . When there happens to be sunshine, the fire ought to be lessened ; and whenever the air is not frosty, the windows ought to be open from twelve till two every day. If a green-house is kept too warm, it will induce premature vegetation, and the plant will waste its strength in an attempt to produce flowers and fruit at a season when nature requires it to be kept in a state of complete repose. Green-house plants should be watered generally every morning ; but in frosty weather water need not be given every day, and some plants will not require watering oftener than once a week. This, however, must depend in a great measure on circumstances ; and, as a general rule, it may be observed that water may always be given in small quantities when the surface of the earth contained in the pot looks dry. The pots should not be allowed to stand in saucers, as stagnant water is peculiarly injurious in winter. Whenever the earth in the pot looks black and sodden, the plant should be turned out of the pot ; and, after the black earth has been carefully shaken from the roots, it should be repotted in fresh soil, an inch or more in the bottom of the pot being filled in with small pieces of broken china and earthen ware.

In February or March the plants should be looked over, and repotted where necessary ; those that are too tall should be cut in, and cuttings made of their shoots. The young plants, raised from cuttings made in autumn, should be repotted in larger pots for flowering ; and where the plants do not require fresh potting, but have the surface of their mould become green and mossy, the moss should be taken off, and the ground slightly stirred with a flat stick, taking care, however, not to go so deep as to injure the roots. When trouble is not an object, all green-house plants are the better for repotting every year, either in spring or autumn ; and when the ball is taken out of the pot for this purpose, it should be carefully examined, and all the decayed parts of the roots should be cut off. Sometimes, when the ball of earth is turned out, nearly half of it will fall off almost without touching it ; and when this is the case, it will generally be found that there is a

worm in the pot. Worms do a great deal of mischief to green-house plants in cutting through the roots, as their instinct teaches them to make their way through the earth straight across the pot and back again, and they cannot do this without tearing the roots asunder every time they pass.

Another point to be attended to in the management of a green-house is, keeping the plants as near as possible to the glass, as, unless this be done, the plants will become what gardeners call "drawn up," and unnaturally tall and slender, from the efforts they make to reach the light.

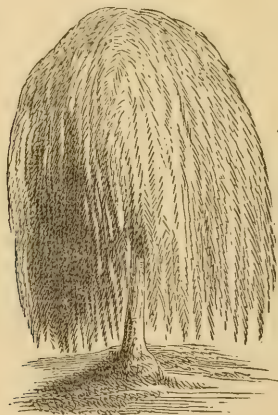
Repotting. — As this process has been frequently mentioned, we here give the best mode of performing the operation. The pot to which the plant is to be removed should always have been previously washed quite clean, and be perfectly dry. Some bits of broken earthen pots should then be put at the bottom of the pot, the quantity varying from three to four pieces, so as just to cover the hole, to a mass an inch in depth, depending upon the nature of the plant. If the plant has not been in a pot before, the roots are then placed just above the broken bits just mentioned, and the earth is filled in, the plant being occasionally shaken, so as to allow the earth to get amongst its roots. The soil in the pots is next consolidated, by shaking it, and then lifting it up and setting it down again with a jerk; the soil being rendered firm and neat around the rim of the pot by means of a broad, smooth piece of stick, shaped somewhat like a table-knife, and called a potting-stick. When a plant has been in a pot before, and is repotted, or shifted, as it is called, into a pot a size larger, the plant is turned out of its old pot by putting the hand upon the earth and turning the pot upside down; or, if the ball of earth does not come out readily, striking the rim of the pot against the edge of the potting-table or shelf. The ball containing the plant will thus drop out into the left hand; and the bits of earthen ware that adhere to the bottom of the ball having been picked off, and any part of the root that appears decayed having been removed, a little mould is put on the drainage in the new pot; and the ball of earth containing the plant having been placed in the centre, the space between it and the pot is filled in with light, rich mould, and made firm with the potting-stick. The operation is concluded by shaking the pot, and then taking hold of the rim with both hands, and striking the bottom of the pot two or three times, with a jerk, against the potting-bench. The plant is then watered, and set in the shade for the remainder of the day.

Heaths are very difficult plants to manage, but a great improvement has taken place in their culture within the last few years. They are grown in a sort of mould, formed by a mixture of peat and sand; and when this earth is put into the pot, it is mixed with good-sized pebbles, some of which are suffered to protrude through the surface of the soil. The roots of heath are

extremely fine and hair-like, and the shelter afforded by the pebbles is so congenial to them, that, if one of the stones be taken out, a cluster of fine, white, vigorous roots will be found below it. The plants are always potted high, so as to let the base of the stem be above the level of the rim of the pot, as the plants are very apt to damp off, if the collar of the plant be buried in the ground. Heaths should never be suffered to become too dry, and never keep too wet. They require little heat; many varieties of old favorites now appear double and triple leaved, with an infinity of different colors. *Foliage plants* have been introduced of late years, and by their differently colored and bright leaves are made to contribute much to the beauty of lawn gardening. All the leading florists furnish catalogues descriptive of the appearance and mode of raising these beautiful plants.

Garden Decorations. — The decorations usual in flower-gardens are introduced either with a view to utility, to convenience, or simply by way of pleasing ornaments; which, if managed with taste and skill, may be brought into according harmony or pleasing contrast with the natural beauties of the flowers, or with the artificial arrangement of their forms and colors. We will specify a few of these different ornamental designs, in order to add to the interest of our remarks in this department. First come *arbors*, which may be either purely natural, partly natural and partly artificial, or entirely

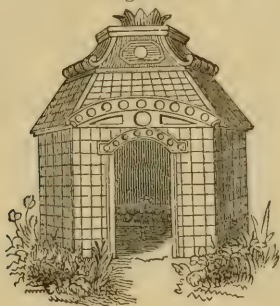
Fig. 273.



the result of art. Of the first are those formed by the banyan-fig, in tropical climes, whose lateral and widely extended branches send down numer-

ous shoots, which fix themselves in the ground. Such are those formed by our various weeping varieties of forest trees, — the weeping-ash, birch, beech, elm, willow, and the like. These trees, with their lithe and tenuous branches, waving with every breeze, are the most natural, and perhaps the most delightful, of arbors. To the second kind belong all those which are formed by the hand of man, aided by some natural suitability of circumstances, or accidental advantages. Thus an aged forest tree may have some appropriate climbing plant placed at its roots, so as to run through its branches and foliage, and ultimately descend gracefully from the extremities, until it nearly touches the ground. The construction of the third kind of arbor depends much on the chances of situation ; and many designs, or minute instructions, would be, therefore, superfluous, as they must be familiar, in their various forms, to almost every reader. The following figure represents a pretty design for an arbor of permanent construction.

Fig. 274.



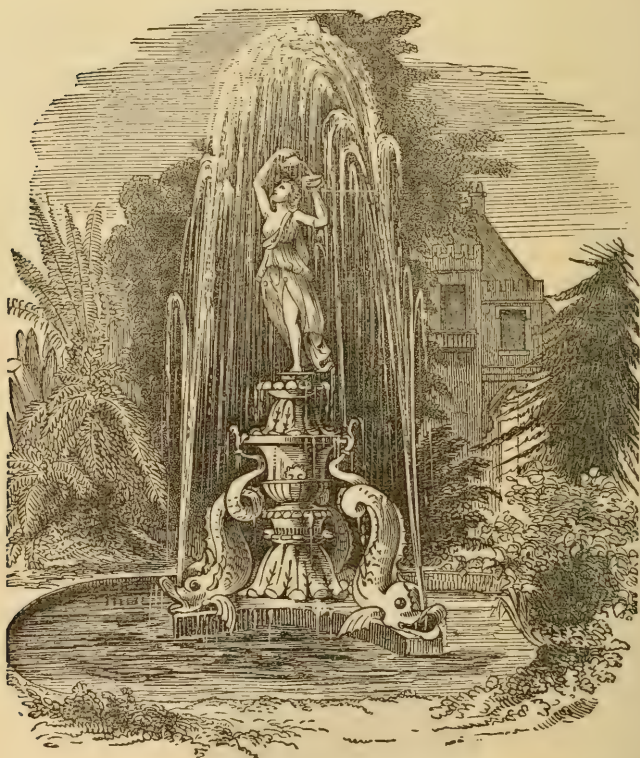
Garden Seats add much to the beauty and attractiveness of a flower-garden. These may be placed either in arbors or under some embowering shade, or

Fig. 275.



in the open garden ; and may be composed of hazel-rods, or straight, small branches of any other tough wood. Five or more young trees, of the mountain-ash, the oak, or spruce fir, bound together, form good rustic columns, around which climbing roses may be trained, and the whole covered in with a light roof, with rampant ivy, clematis, or jasmine, as in Fig. 275. For occasional convenience, the various forms of the Turkish tent may be adopted ; and when pitched on a lawn, amongst clumps of flowers in the modern style,

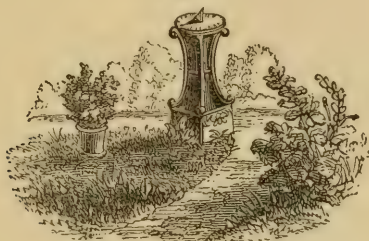
Fig. 276.



has a very agreeable effect. Besides arbors and garden-seats, *vases* may be introduced with good effect ; also, *fountains*, *flower-stands*, *aviaries*, and *sun-dials*, in all the different styles of workmanship. The latter, when set in an unshaded part of the garden, and mounted on a column, around which

some flowering plant has been trained to climb, will form a very pleasing object. We give a cut of one of these.

Fig. 277.



DESCRIPTION OF STANDARD VARIETIES OF FLOWERS.

Althea Frutex. — This is a beautiful shrub, requiring a warm and sheltered situation in the Northern States. Sow the seeds in spring, and protect the young plants during the winter.

Almond (Double Flowering). — A shrubby plant, bearing beautiful rose-like flowers in the spring. It is propagated by suckers.

Amaranthus Tricolor. — An annual plant, with a beautifully variegated foliage of red, green, and yellow. The seed is found in little tufts about the stalk, and may be sown in April or May.

Animated Oats. — An annual plant, and resembles the common oats while growing. The seeds are clothed with a stiff down, and have appendages like the legs of some insect, with apparent joints. They are affected by the changes of the weather, and, of course, are continually moving. If they be wet, they will turn over several times, and twist about. If wet, and held to a lighted lamp, they exhibit such motions of apparent agony as an insect would, placed in a like situation.

Aster, China. — An annual, producing many splendid flowers. There are several varieties, as red, white, purple, yellow, striped, quilled, &c. The seed should be sown early in the spring. It flowers late, but is destroyed by severe frost.

Auricula. — There are several species. It may be raised from seed, but like does not produce like, in all cases. They are best raised by dividing the roots, which send out several young plants annually. They are tender, and, if planted in open ground, they must be well covered, and be kept from severe frost and rain during the winter. They are well adapted for pots, to flower in the house.

Azalea Nudiflora. — It is commonly known as the *American Honeysuckle*,

and includes several species. It bears abundantly, the flowers having a fine perfume and making a very handsome show.

Box. — A low, delicate shrub, which may be pruned to any shape to please the fancy. It is an evergreen, hardy, and suitable for borders. It is grown by cuttings, or by dividing the roots. If a plant be placed deep in the earth, and the soil be brought in close contact with the small branches (being spread as much as possible), they will send out roots, and furnish a large number of small plants. In trimming this shrub, let the operation be done well, using the proper utensils.

Fig. 278.

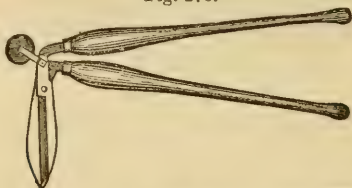
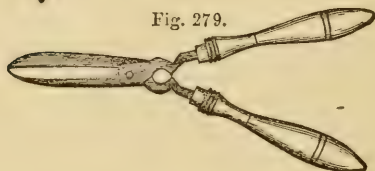


Fig. 279.



Brier, Sweet. — A well-known rose-bush, hardy, adapting itself to a poor soil. The foliage and flowers are bright, and delightfully fragrant.

Canterbury Bell. — A biennial plant, bearing large blue flowers, which are much admired, and make a fine appearance.

Carnation. — A biennial and perennial, comprising several superb varieties. May be grown by layers. While it is in flower, it sends out several side shoots near the root; these are pinned down in August, a little under the earth, leaving the extreme part erect; in a little time they take root, and the new plant must be severed from the old, and transplanted. The old plant does not always stand another winter; therefore its branches are used to continue the species. Carnations are rather tender as to frost, and must be covered, in the Northern States, to live through the winter. It is best to put them into large pots, and keep them in a green-house or parlor, or in some place where they can have air and light during winter.

Cassia Marylandica. — This is a perennial plant, producing many small yellow flowers, suitable only to stand in a border. It is hardy, and is propagated by seed.

Catalpa. — A beautiful tree, raised by seed. Much admired for its foliage and showy flowers, which are very ornamental in the garden.

Cherry, Double-flowering. — This is one of the most beautiful trees in the flower-garden or shrubbery; cultivated the same as the common cherry-tree.

Chrysanthemum Indicum. — A fine perennial plant, hardy, flowering brilliantly late in the autumn, and comprising several varieties. The plants may remain in the open ground until late in the fall, and then be taken up and placed in pots. When the frosts appear, keep them in a warm room until after flowering, and then put the roots in the cellar or open ground. They will flower in the garden, if carefully attended to. Raise by dividing the roots.

Clematis, Austrian. — A perennial plant, producing very pretty flowers. It is best propagated by dividing the roots.

Clethra. — A well-known plant, bearing clusters of fragrant flowers in the fall.

Columbine. — A very common perennial, including different species; very neat.

Convolvulus. — Many species — annual. *Convolvulus major* is commonly called *Morning Glory*. It is a vine, and a great runner — many colors. *Convolvulus minor*, called *Beauty of the Night*, because it blossoms at evening — many colors. Sow the seed early in the spring.

Corchorus Japonicus. — A shrub frequently cultivated in green-houses, but may be grown in the garden. It bears wreaths of golden-yellow flowers.

Crocus. — A bulbous-rooted plant, hardy, early; colors, blue, yellow, white, purple, &c. It is grown by the bulbs. A pretty pot-flower.

Cupid's Car, or Monk's Hood. — A fine, vigorous annual, bearing a profusion of pretty blue flowers, during the summer and fall. Propagated by a division of the roots. A very neat plant for the flower-garden.

Dahlia. — A beautiful Mexican flower, embracing many varieties of color and shade. A somewhat sandy or gravelly soil is thought best, in order to prevent their growing too luxuriant, and to obtain more flowers. They may be raised by seed, or by a division of the roots. Sow the seed in March, in pots, and place in a hot-bed or green-house. About the middle of May, or when there is no danger from frost, plant them out in the borders, or wherever they are to stand; and as they increase in height, let them be well supported by stakes, to prevent the wind breaking them down. The roots are tuberous, resembling a sweet potato, and should be taken up in October or November, and preserved through the winter in a box filled

with dry sand, placed out of reach of the frost. Plant only those which have a bud, and divide the roots carefully.

Daisy. — A small, delicate, perennial plant, producing small but attractive flowers. It is hardy, and will bear flowers through the winter, if kept in pots or boxes, in the house. Raised by offsets.

Dwarf Basil. — A very fragrant annual, raised from the seeds.

Eupatorium (Blue). — Perennial; bearing a profusion of beautiful flowers, and propagated most readily by dividing the roots.

Euphorbia Lathyris. — This is a biennial plant, commonly known as the *Caper-tree*. It is singular in its foliage. Rather tender. Propagated by seed.

Fading Beauty, or Morning Bride. — An annual plant, producing handsome flowers, which last but a few hours, or less. Plant the seed in spring.

Forglove. — A handsome flowering biennial and perennial plant, comprising several varieties. Sow the seed in spring, covering lightly with earth.

Fringe Tree. — A handsome shrub, covered with white flowers. Hardy, and will grow in any soil, but flourishes best in moist ground.

Geranium. — There are many varieties of this much-admired plant. Some give flowers, with little or no leaf; others possess beauty of leaf, as well as of flowers: some give no perfume; others are delightfully fragrant. It is easily propagated by cuttings from any part of the plant, old wood or young, and placed in pots. In a green-house, or parlor, they will bloom in winter.

Garden Angelica. — Perennial; bold and showy when in flower. Raised from the seed, and well adapted for some situations in the garden.

Glycine. — A perennial vine, bearing variegated flowers. It will grow on the side of a house or wall to a great extent, making a fine appearance. It is propagated both from seed and layers.

Golden Corcopsis. — This is an annual, bearing a profusion of rich, brilliant yellow flowers, having a purple centre. It is easily raised from the seed.

Golden Everlasting. — A somewhat peculiar plant, bearing a late, bright yellow flower, which, if taken off before the seed ripens, will retain its brightness for many years. Plant the seed early in the spring.

Hollyhock. — A hardy, perennial plant — showy for a shrubbery. There are several varieties, — the single, double, white, red, yellow, dark, &c.

Honeysuckle. — This plant is very beautiful in its place: it climbs up houses, and over hedges; it forms arbors and bowers; it blooms in clusters. There are several varieties. The *Italian* produces an abundance of changeable flowers early in the season, diffusing a rich fragrance all around. The

Variegated blooms monthly, and is very fragrant. The *Scarlet Trumpet* also blooms monthly, — scarlet flowers, making a handsome appearance. It may be grown by seeds and cuttings, but best by layers.

Hyacinth. — A bulbous-rooted plant, and, like all other plants of this class, is perennial. It is an early, beautiful, and fragrant flower. It will bloom in glasses filled with water, in a room, but better in pots of earth. It is best propagated by offsets. While the parent root is blowing, it sends out several young ones. They should be planted at a depth of four inches. There are many varieties of this admired flower, both single and double; the former have the brightest colors, but the latter are generally preferred.

Hydrangea. — This is a small shrub, producing large and changeable flowers, being at first green, then becoming gradually rose-colored, and afterwards green, occupying about six months. It is a house-plant — will bear some frost, but should be kept, during the winter, in a green-house, parlor, or a cellar where there is some light. Propagate by cuttings.

Ice Plant. — A well-known annual, having a peculiar icy appearance. Plant the seeds in pots, in the spring.

Impatiens Balsamina. — Commonly known as *Balsamine*. A very fine annual plant, bearing a profusion of gaudy flowers. There are several varieties, — single and double, rose-colored, red, white, crimson, purple, and variegated. It commences flowering in July, and continues till cold weather. Sow the seed in May.

Iris, or *Flower-de-lis.* — A hardy, perennial plant, comprising many varieties, both large and small; a favorite plant, raised by dividing the roots.

Lagentrænia Indica. — A flowering shrub, which endures the winter of the Middle and Southern States, but requires attention further North.

Laburnum. — A tall and handsome shrub, loaded, when in bloom, with yellow flowers. Sometimes called *Golden Chain*. It is raised from seed, and requires a warm and sheltered situation.

Larkspur. — An annual plant, of no fragrance, but of great variety of colors. It makes a pretty appearance, and is raised from the seed.

Laurel (Broad-leaved). — This is an evergreen shrub, bearing flowers of great delicacy and beauty, being white, tinged with red.

Lilac. — A large, shrubby tree, hardy, and handsome when in bloom, having large bunches of fragrant flowers. The white and the purple may be easily grafted or inoculated into each other, and when the shrub, with a handsome head, is thus managed, some branches producing purple and others white flowers, the show is very fine. It is raised from suckers, of which it sends out a great many, but from which it should be freed as much

as possible. The Persian lilac is a neater shrub, bearing delicate white flowers. It is propagated by suckers.

Lily. — There are many varieties of this plant. The *White* grows three or four feet high, and bears large, white, sweet-smelling flowers. The *Tiger* grows one or two feet higher, producing gaudy spotted flowers. The *Martagon* is similar to the latter, but more delicate: all these are bulbous-rooted, and are best propagated from offsets. The *Asphodel* grows to the height of two feet, and bears handsome yellow flowers; it is propagated by seed or offsets. The *Lily of the Valley* is a small dwarf plant, that thrives best in the shade, producing small, delicate flowers, of a sweet odor. Raised by offsets.

Lime Plant. — A singular plant, the stem, foliage, flower, and fruit, being formed in the earth, and, after the plant has come up, there is nothing more than the extension of parts. The stems, when from eight to twelve inches high, branch out in two arms, at the extremity of each of which is a large palmated leaf. In the fork proceeds the fruit-stem. The first that is seen in the spring is a delicate membranous cap, which is soon burst open by the flower-bud, which is large, round, and white. Next appear the shoulders and arms, lying close to the stem or trunk; and as the plant rises, the fruit-stem elongates and the arms elevate themselves. The fruit is about the size of a large lime, — green while growing, and yellow when ripe. A moist soil, in a shady situation, is best. Propagate by seed, or by dividing the roots, which are creeping and jointed.

Lobelia. — A very interesting genus of flowering plants, alike pleasing to the eye, and useful to the pharmacist. The green-house, hot-house, shrubby, and herbaceous kinds, grow well in a mixture of peat and sand; the shrubby kinds being readily increased by cuttings, and the herbaceous species by division as well as by seeds. The hardy, herbaceous varieties flourish in a light, rich earth; but in the cold weather of the winter season, most of them require the protection of a frame. The green-house annuals and biennials must be sown in pots; but those of the hardier plants may be sown in the open border. The *L. longiflora* is a very venomous plant, fatal results following its use.

Lungwort is the common name of a species of remarkably-pretty flowering plants, well adapted for ornamenting the fronts of shrubberies. They are easily increased by divisions, and will thrive in any ordinary soils. Their generic name is *Pulmonaria*.

Lychnadia. — A perennial plant, comprising several varieties: purple, white, striped, &c. The plant is hardy, bears an abundance of delicate

flowers, and continues long in bloom. It is best propagated by dividing the roots.

Magnolia.—A very elegant and showy plant when in flower, and one which deserves extensive cultivation. Being a remarkably handsome shrub, it should be planted in a conspicuous situation, where it will bear a profusion of flowers when it attains a good size.

Mezereon.—This is a small and beautiful shrub, blooming in the month of March, with a profusion of fragrant flowers. Hardy; raised by seed.

Mignonette (*R. odorata*), an old and universal favorite, emits a very pleasant odor from its flowers. It is usually an annual, but, by greenhouse cultivation and constant pruning, it may be rendered perennial, and even shrubby.

Musk Geranium.—An annual plant, having a strong musky odor. It will stand the winter in a common hot-bed. Plant the seed early.

Myrtle (*Evergreen*).—An evergreen vine, including several species bearing a pretty blue flower. A favorite plant for ornamental purposes.

Narcissus.—A bulbous-rooted plant, managed like the hyacinth. It bears an early, beautiful, and fragrant flower. It is hardy, and well

Fig. 280.



adapted to bloom in a pot in the green-house or parlor. Raised by bulbous offsets, which increase every year. *Polyanthus Narcissus* and *Jonquils*, both elegant flowering plants, are propagated and cultivated in the same manner.

Nasturtium.—An annual plant, with showy flowers. The seeds are enveloped in fleshy pods, and should be sown very early in spring. The plants should be supported from the ground by bushy sticks.

Oleander.—A noble-looking, evergreen shrub, easily cultivated, and flowering freely during the greater part of the year. It grows well in a rich, light soil—and young cuttings root in any soil, if kept moist.

Passion Flower.—This is a beautiful and celebrated flower, growing on a perennial vine; the name originating from the large *cross* in the middle

Fig. 281.



of the flower, surrounded by appendages resembling a *glory*. The plant has a succession of flowers for a long time. It is tender, suitable for the green-house, but will not endure a northern winter in open ground. It is best raised from cuttings.

Pæony.—A perennial plant, bearing a gorgeous but short-lived flower. There are several species. Propagate from offsets.

Pea (Sweet).—There are many species of this annual, varying in color and scent. The *Everlasting Pea* is perennial, and produces many clusters of showy flowers, which remain in bloom a long time. Plant the seed early in spring.

Peach (Double Flowering).—A very showy tree, bearing flowers of the size of a small rose. It is hardy, and managed like other peach trees.

Pink.—A well-known perennial plant, fragrant, and embracing many varieties as respects size and color. A fine flower, and easily grown by seeds, layers, &c.

Polyanthus.—A hardy, perennial plant, bearing handsome flowers. There are many varieties, and the plant blooms best in a shady situation; best propagated by dividing the roots. *Polyanthus Narcissus* is a very pretty perennial, bulbous-rooted, and easily grown by offsets.

Primroses.—A numerous family of small, but very pretty and desirable plants. The principal species are: *The Common Primrose*, which bears numerous, large, sulphur-colored flowers, with a darker radiating spot in

the centre. Scent slight, but agreeable. There are varieties of this species which produce both single and double flowers, of white, brown, and purple colors. *The Bird's-Eye Primrose*, which bears beautiful rose-colored flowers, fringed with a notched, yellow, glandular border.

Pyrenium Parthenium (commonly called *Double Feverfew*).—A hardy perennial, producing large quantities of white flowers, and continuing in bloom a long time. It is easily propagated by the seed.

Poppy.—An annual plant, admired for its great variety in size and in flower. The double are very showy, but of short duration. Easily grown by seed.

Purple Hyacinth Bean.—An annual runner, bearing large clusters of purple flowers, much admired. Plant the seeds early, and preserve from frost.

Rhynchospermum jasminoides is a beautiful climbing-plant, of Chinese origin, peculiarly adapted to green-house cultivation in the United States. The flower very much resembles that of the jasmine, and exhales a delicious odor. It is an evergreen, and sends out rootlets along the stem when brought in contact with the ground, rendering it of easy propagation by cuttings. It commences flowering in April in the green-house, and continues to bloom for six weeks or two months.

Rose.—Of this deservedly-popular flower there are many varieties, as to size, foliage, beauty, and fragrance. They may be propagated from seed or by suckers—the latter being the most certain and easy mode. The

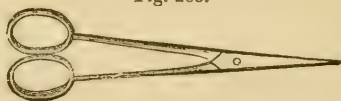
Fig. 282.



suckers should be those which come out near the old stems, during the summer, and, when planted, should be cut down to four or five inches from the ground. Plant in October, November, or April. Keep the ground good, and dig it every autumn. They should, except when trained against a

wall, be cut down to a certain height, according to their natural size; for when the stems and limbs are long, they produce fewer flowers. All the weak, dead or dying wood should be pruned out close, without leaving any ugly stubs. The *Yellow Rose* requires an airy situation and a gravelly soil, and every autumn one half of the old wood should be cut down within four inches of the ground; by this means a succession of thrifty, blooming shoots will be kept up. The *Chinese Monthly Rose* is grown by cuttings, taken in the spring and properly placed in moist earth. It is a tender plant, and should be taken into a green-house or parlor during the winter. Some of them, however, are hardy, and withstand the frost. When gathering roses

Fig. 283.



and other flowers having thorny stems, a pair of scissors, combining tweezers or pincers (Fig. 283), are very useful.

Rose Acacia. — This is a singular shrub, producing many clusters of flowers, much admired. Propagated by shoots from the roots.

Rose-colored Hibiscus. — A perennial plant, producing very showy flowers, and making a good appearance in a border. Raised by seed.

Rudbeckia. — A perennial plant, producing many flowers, which are very durable, and much admired. Propagated best by dividing the roots.

Scarlet Cacalia. — A small annual plant, producing numerous scarlet flowers, very showy. Easily raised from the seed.

Scarlet Lychnis. — A perennial plant of two kinds, the single and the double, the latter being very handsome. The former is propagated from seed, and the latter by dividing the roots.

Snowberry. — A small shrub, producing clusters of beautiful white, wax-like berries, in autumn. Propagated best by suckers.

Spiderwort. — A singular perennial plant, in bloom for a long time. The blue is more admired than the white. It requires a light covering during the severity of winter weather. Propagated by dividing the roots.

Spiraea. — A small shrub, loaded with delicate flowers in the season of its blooming. Propagated by suckers.

Syringa, or *Mock Orange*. — A shrub, bearing flowers quite similar to those of the orange, and making a very pleasing appearance when growing with other shrubbery. Propagated by suckers.

Strawberry Tree. — This is a handsome shrub, bearing, in autumn, an

abundance of fruit, somewhat resembling the strawberry. The European is preferred to the American. Grown by seed and by suckers.

Sweet Bay. — This is a very pretty evergreen shrub, well calculated to stand, in a large pot, in the parlor, during winter. It is propagated very easily, by suckers.

Sweet William. — An imperfect perennial, producing very beautiful flowers of small size. It is grown by seed, the plants of which do not produce flowers like those of the parent plant, except by chance. It may be propagated by dividing the roots.

Tulip. — In no family of plants has nature so multiplied her beautiful tints as in this, — there being several hundred varieties. It may be raised from seed, but the plants do not produce flowers like those of the parent plant, except by chance. They are raised best by bulbs. After flowering, the foliage and roots decay, and a bulb or bulbs are formed of the juices of the old plant. A bulb contains all the parts of the future plant, and soon becomes as much disengaged from the decayed plant as the ripe acorn is disengaged from its parent tree. At this time they may be carried, like many other bulbs, any length of distance, in dry moss or dry sand. They should be planted out, about three inches below the surface, in a rich soil, in August or September; after which, they throw out roots, and prepare for an early appearance in the ensuing spring. If the bulbs be kept through the winter and planted in the spring, they will not thrive so well that season. The nicer varieties should be taken up after the decay of the old plants, every year, air-dried, and kept until September or October, and then planted.

Violet. — This little plant is perennial; the flowers blue, double, and fragrant, blooming early and long. Propagate by dividing the roots.

II. SHRUBS.

Soil. — With respect to soil, hardy shrubs may be conveniently considered as constituting two great divisions; one requiring any common garden soil, and the other requiring a large portion of peat or leaf-mould.

With regard to the first division, a rich, light, hazel loam is suitable to the greater number of the plants, though some will thrive in the poorest soils; but in this there is great diversity. After having taken out the original soil of the border, about a foot and a half or two feet deep, — though three feet will do no harm, — fill in the vacancy thus formed with peat or compost raised above the garden level, to allow for subsequent sinking.

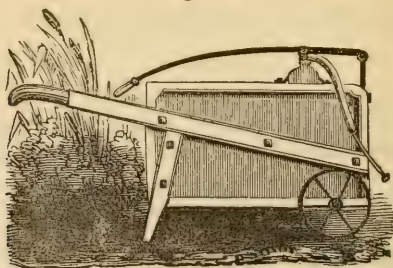
Seasons and Modes of Planting. — With respect to shrubs that shed their leaves on the approach of winter, they may be removed with safety as soon

as the leaves have begun to fall in October. With respect to shrubs which do not shed their leaves and are evergreen, they may, if carefully taken up, be planted at any season of the year, provided advantage is taken of dull or dripping weather. But, notwithstanding, there are particular seasons when they will thrive better and grow more freely than at others.

If the situation be dry, and the soil light and sandy, evergreens, with the exception of hollies, should be planted as late in November as the weather will permit. But in the case of a bad situation, with a soil retentive of moisture, May is the preferable season. Hollies should always be removed in June.

When the plants are large or rather old, good balls should, if possible, be taken up with them, and all the fibres of the roots that can be got up without bruising or injury. Whatever may be the state of the weather, it is important to keep the roots as short time exposed to the air as possible. If only a few minutes, so much the better. In all seasons, situations, and soils, the plants should be well soaked with water as soon as the earth is put about the roots. As soon as a plant has been put into its place, the earth should be filled in, leaving a sufficient hollow around the stem, and as far as the roots extend, to hold water, which should then be poured in, in sufficient quantity to soak the ground down to the lowest parts of the root. By this practice, which is particularly necessary in spring and autumn planting, the earth is carried down by the water, and every crevice among the roots is filled. Care must always be taken to have as much earth about the roots of the plants as will prevent them from being exposed when the

Fig. 284.



water has subsided. After the first watering has dried up, the earth should be leveled around the stem of the plant, and as far out as the water has been put on, but not trodden. If the plants are large, a second watering is sometimes necessary, but in ordinary-sized plants one watering is quite suf-

ficient; and after remaining twenty-four hours, more or less, according to the nature of the soil, the earth about the stem and over the roots should be trodden as firm as possible, and after treading should be dressed with a rake. The garden engine is now much used, in watering gardens, nurseries, &c. Fig. 284.

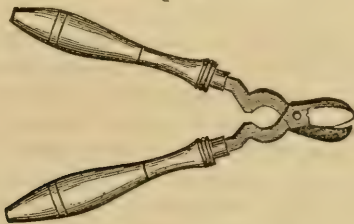
After-management. — If the season be very dry, it will be important to lay round the roots a quantity of moss, or cut grass. Whilst the plants are small, care must be taken not to let them be stifled or choked with rank-growing weeds, nor by the increasing growth of contiguous shrubs, and to clear away all rubbish that might retard their shooting; also stir the surface of the ground frequently with a hoe, to prevent the surface becoming hard and caked in dry weather. The branches must be trimmed off, too, which may be done by means of the implement below, — called a briar or bill hook, — as they grow too large or luxuriant, or overhang and smother each other.

Fig. 285.



Situation and Arrangement. — Some shrubs thrive best in a dry and elevated situation, and will not grow when crowded amongst others, or in low, damp ground, where other sorts grow the most luxuriantly. These and other circumstances must be attended to, in the disposal of the several roots. The beauty of the plants cannot be displayed, indeed, when they are too much crowded, as they are then certain to be drawn into unnatural shapes. The more frequently, therefore, that open spaces can be omitted, the more

Fig. 286.



will the shrubs exhibit themselves to advantage. Keep them well trimmed, using the pruning-shears (Fig. 286) freely, whenever necessary.

One of the most important things, in planting shrubs, is to attend particularly to the shades of green, especially where the view from the house or lawn catches the trees. Flowers, which Pliny elegantly calls the joy of trees, continue but for a short period in comparison with the duration of the leaves, and, therefore, the more permanent picture should be executed by judiciously contrasting the greens. Even the effect of perspective may be considerably increased by the proper arrangement of hues. Shrubs, whose leaves are of a gray or bluish tint, when seen over or between shrubs of a yellowish or bright green, will seem thrown into the distance. Those, again, with small or tremulous leaves should wave over or before those with large, broad-fixed foliage. The light and elegant acacia, for example, has a more beautiful effect when its branches float over the firm and dark holly, or sweet bay. When the situation will permit, three or five lilacs may be grouped together in one place, and as many laburnums in another, so as to give effect in various parts by a mass of color. The guelder rose should appear as if escaping from the bosom of evergreens, and not a plant should be set in the ground without adding to the harmony of the whole.

A shrubbery should be planted as a court or stage dress is ornamented — for general effect, and not for particular and partial inspection. Boldness of design, which seems to be more the offspring of nature and chance than of art and study, should be attempted ; but all harshness or too great abruptness must be avoided, by a judicious mixture of plants whose colors will blend easily into one another. The most beautiful shrubs should, of course, be planted in the most conspicuous and prominent places ; a projecting part of the shrubbery, for instance, should be reserved for the rhododendron, the azalea, and other similar sorts, with which may be planted the hardier heaths. With respect to evergreens considerable judgment is required, in order to relieve their uniform appearance during winter. This may be done by skilfully arranging different kinds, and those with variegated leaves, such as aucuba, japonica, and green holly, or those which retain their brilliant berries during the cold months, such as pyracantha.

A well-planted shrubbery depends not so much for its beauty on the expense or rarity of the plants it contains, as on the selection of the sorts which succeed each other in blossoming throughout the year, or whose various-colored fruits grace them for the longest duration of time. It is not, accordingly, so much the shrubs, exclusively the ornament of the summer months, which alone require attention, but such also as will contribute to the gayety of the morning and evening of the year ; so that the gloom may be banished at all times, as much as possible, from the grove, and nature's repose shortened between the plaintive good-night of autumn and the cheerful good-morrow of spring. For this purpose, plant the hazel and

filbert, as among the trees which blossom first; and even the furz-bush is a great enlivener of the shrubbery at this dull season, particularly when its golden blossoms are expanded at the foot of some dark-foliaged evergreen.

Varieties.—Among the numerous kinds of ornamental shrubs may be mentioned, for a select assortment, — Rose Acacia, dwarf white-flowering Horse Chestnut, scarlet-flowering Chestnut, Strawberry tree, double-flowering Almond, Snow-ball, Japan Sophora, Spice-bush, Rose of Sharon, Lilac, Carolina Syringa, Spirea, Mountain Rose, Mountain Laurel, Azalea, Calycanthus, Honeysuckle, Hawthorn, Prim, Juniper.

III. ORNAMENTAL AND USEFUL TREES.

Varieties.—The most common, hardy, and esteemed ornamental trees are the Abele, Ailanthus, Ash, Basswood, Elm, Horse Chesnut, Linden, Locust, Rock Maple, Tulip Tree, and the different varieties of the Willow.

The best and most handsome evergreens are, the Cluster Box, Common Box, Magnolia grandiflora, American Silver Fir, European Silver Fir, Larch Pine, Scotch Pine, American White Spruce, Norway Spruce Fir, Evergreen Cypress, and Hemlock.

SUGAR MAPLE.—With the exception of the oak and the pine, no tree has obtained more celebrity than the sugar maple (*Acer saccharinum*). Its neat appearance, and the beauty of its foliage—in summer of the liveliest green, and in autumn assuming the richest and most glowing red color—recommend it as a beautiful ornament for gardens, lanes, and groves; and its culture is really a matter of some importance to the farmer, who may readily perpetuate and extend it. Planted out around the farm-house, along the lanes, and in the fence-corners, it serves the double purpose of an ornamental shade-tree, and of a never-failing sugar producer. If this plan is not adopted, three or four acres could not be devoted to a better use than as a sugar orchard. The trees may be planted in rows ten feet apart each way, and the soil loosened around them in a circle six feet in diameter, and to the depth of two feet. The rapid growth of the transplanted trees will depend in a great measure on the care used in their removal from the forest to their new location. If thrifty, they will be ready for tapping in fifteen years; and, if they do not profit the person who plants them, they will be a valuable legacy to his posterity.

Tapping the trees.—In ordinary seasons the best time for tapping the trees is from the 15th of March to the 15th of April, when the weather is mild during the day, but cold and frosty at night. The first thing necessary is the preparation of spouts and buckets. The former are made of soft maple or ash, turned in a lathe; and the latter are entirely composed of the wood of the ash. Two spouts are made for each tree—one, in-

tended for the lower orifice, is quite tapering, three inches in length, and has a wire fixed upon the end, by which a bucket may be hung upon it; the other is six inches long, and made in the usual manner. The buckets have a capacity of three or four gallons, and are so suspended from the short spout, that they can be emptied without removing them. These preparations completed, the next step is to tap the trees, which is done with a half-inch augur—the lowest orifice being made about twenty inches from the ground, and the other three inches higher up. The holes at first should not exceed three-fourths of an inch in depth, and they should have a sufficient inclination to cause the sap to flow freely in freezing weather; otherwise, it is liable to congeal in the mouth of the orifice. When the flow of sap begins to slacken, the holes may be increased to the depth of two and a half inches, for which a larger augur may be used. The spouts should not enter the holes farther than half an inch, as the deeper they are driven, the more will the sap be obstructed in its flow. The sap may be collected daily from the trees, and put into large tubs, preparatory to boiling down.

Boiling the Sap.—The sap should be boiled before fermentation commences, which, as the weather becomes warm, will generally occur about the second or third day; and the greater the extent of surface exposed to the atmosphere while boiling, the more rapid will be the evaporation. The best apparatus are large copper pans, six feet long, three feet wide, and nine inches deep, fixed over a furnace made of brick-work. While boiling, the scum should be skimmed off as rapidly as it rises, and as the quantity of the liquid increases, fresh juice should be added. A teaspoonful of slaked lime should be added to every fifteen gallons of sap, which causes the impurities to rise, and neutralize the gallic acid. To prevent the sap from boiling over the sides of the pan, a piece of pork-fat may be suspended in it, or the inner rim of the pan be rubbed with the same substance. Charcoal is the best fuel to use, as, though a strong heat is required, it should be an equable one, and be confined entirely to the bottom of the pan. When the sap has been reduced to a syrup, it should be strained either through a hair-sieve or a woollen cloth, and then allowed to stand a few hours to settle; after which, it may be drained off carefully from the sediment which has settled at the bottom.

Clarifying.—After the syrup has been properly strained, it should be returned to the pan, and the clarifying materials, such as milk, eggs, or calves' blood, added. The impurities combine with these substances, and rise with them to the surface in the form of a thick scum, which should be carefully skimmed off. When the syrup is sufficiently reduced, which may be judged of by the manner in which it strings on being drawn out

between the finger and thumb, it should be removed from the fire, emptied into large, shallow troughs, and stirred well for some time, until it grains; for if poured at once into moulds, it will take the form of candy, and not that of sugar. When properly granulated, the sugar should be put into conical moulds, or barrels with holes bored in the bottom, and set aside, to drain off the molasses.

Claying.—In two or three days after the moulds or barrels are unstopped at the bottom, mix white clay with water until it takes the form of a creamy paste, and with this cover the top of the sugar to the depth of one and a half inches. When this covering dries, remove it, and supply its place with a fresh layer about two inches thick. The sugar is thus reduced in quantity, but its quality is correspondingly improved, and the amount of molasses greatly increased.

Molasses and Vinegar.—These are usually made from the last runnings, the sap then containing a larger proportion of mucilage, and being less adapted for making sugar. This molasses, when properly clarified, is superior to that made from the sugar-cane, and possesses a peculiarly grateful flavor. The vinegar, however, though excellent for table use, is not available for pickling purposes.

EVERGREENS.—The value of evergreens for purposes of use and ornament has not, until recently, been fully appreciated. In many bleak situations, at least one-half the winter fuel may be saved by planting from forty to sixty good evergreen trees across the sweep of the prevailing winds, and they will also serve as a shelter to cattle during the winter, breaking the force of the cutting winds to which the poor animals are frequently exposed in the open fields. This may not be an object in a thickly-settled country, where cattle are comfortably lodged under sheds, or in barns; but on the bleak Western prairies, not a tithe of the cattle ever have the benefit of a shelter, and there these evergreen shelters would prove both advantageous and economical. As an ornamental tree they cannot be excelled, since they are always objects of beauty, and produce a fine picturesque effect in the landscape.

The Cluster Pine (*Pinus Pinaster*,) thrives well in a sandy soil, but refuses to grow in calcareous land. It is indigenous to the south of Europe, is a rapidly-growing tree, and very hardy.

The Box (*Buxus sempervirens*,) is a beautiful evergreen shrub, of which there are several varieties, ranging from the dwarf size to that of a tree twenty feet high. It is indigenous to Europe and Asia, of slow growth, but attains a great age; and its small, coriaceous, bright green, shining leaves, are very enduring.

The Magnolia grandiflora (Fig. 287,) is a beautiful evergreen tree, in-

digenous to the Southern States, which grows to a height of from forty to sixty feet. It forms a rounded pyramidal head, well covered with large,

Fig. 287.



coriaceous, shining leaves, of great size and beauty, which form a pleasing contrast with its white flowers, from which a most delicious perfume is exhaled. It does not thrive north of latitude 35° , not being sufficiently hardy to stand the climate.

The American Silver Fir (*Picea balsamea*,) is a pyramidal tree, seldom growing more than thirty feet in height. It is very hardy, and, when standing alone, forms a perfect pyramid.

The European Silver Fir (*Picea pectinata*,) (Fig. 288), found upon the mountains of Central Europe, is remarkable for the regularity and symmetry of its form; the heads of these trees being always pyramidal. It is of slow growth, but attains a height of 180 feet, with a straight stem, and regularly-whorled branches, which stand out horizontally. The upper side of the leaf is of a very dark shade of green, with silvery lines beneath.

The Larch Pine (*Pinus laricio*), indigenous to the Island of Corsica, is a rapid grower, and hardy as far north as Lat. 42° . It attains a height of 150 feet, and bears leaves varying from four to eight inches in length, according to the age of the tree.

The Scotch Pine (*Pinus sylvestris*,) succeeds remarkably well in the United States. In favorable situations it grows to the height of 100 feet. The leaves are glaucous, and in pairs. They do not drop from the tree until the fifth year. It is very hardy.

The American White Spruce (*Abies alba*,) is a very hardy tree, somewhat resembling the Norway spruce, though it is neither so large, nor so fine-looking.

Fig. 288.



The Evergreen Cypress (*Cupressus sempervirens*,) (Fig. 289), a native of the islands of the Archipelago, has been found to thrive well in the

Fig. 289.



Southern States. It is a tapering, cone-like tree, with upright branches, growing close to the trunk. The branchlets are dichotomous, and covered closely with overlapping scales or leaves, which are yellowish-green, shining, and remain on the tree five or six years. It does not suit a northern latitude.

Fig. 290.



The Norway Spruce Fir (*Abies excelsa*,) (Fig. 290,) is one of the loftiest of European trees, frequently attaining a height of 180 feet. It is a beautiful pyramidal tree, with a straight trunk, and pendulous branches and twigs. It succeeds well in the United States, being able to withstand the most severe winter, and forms an excellent shelter from the rude blasts.

The Hemlock Spruce Fir (*Abies canadensis*), one of the most beautiful of American evergreens, is a tall, pyramidal tree, well furnished with slender limbs, which decline gracefully, forming a cone of perennial dark green, which forms a very refreshing relief in a landscape. It is very hardy, and will grow almost anywhere.

OSIERS.—There are several varieties of this species of willow; but we have only space to notice those which are used in basket-making, &c.

The Common Osier (*Salix viminalis*,) grows in wet meadows, and sends out long, slender branches, which are round, polished, and, when young, covered with fine silken hairs. This variety is very much esteemed among basket-makers. *S. Forbiana*, used for making the finer kinds of basket-work, grows erect and bushy, with upright, slender, smooth twigs, of a greenish-yellow color, very flexible and tough. *S. Rubra*, or green-leaved osier, a small tree, with long, smooth, tawny branches, which are very tough and pliant, is one of the most valuable varieties, if cut down yearly.

Mode of Cultivation.—Select a low, wet piece of ground, turn up the soil to the depth of twelve inches, and prick down cuttings of four years' growth, and eighteen inches long, at a distance of about three feet from each other. Fence them around with dikes or hedges. The best time for setting out osiers is during the winter months.

MONTHLY FLORICULTURAL CALENDAR.

JANUARY.—The chief business of this month is increasing the stock of potted flowering-plants, some of which will require the assistance of a slight hot-bed to bring them forward. This is to be understood as a means of preventing them going back, rather than forcing them prematurely forward; it will also be a means of advancing seedlings fit for pricking out into other hot-beds, next month. A very moderate degree of artificial heat is sufficient.

FEBRUARY.—The business of this month depends much on the kind of weather which prevails. If cold, wet, and inclement, very little can be done in the open garden, except protecting the bed-plants; but if the weather be remarkably open and dry, something may be done in the way of preparing the ground for the hardier annuals. A slight hot-bed will be required to raise seedlings of various sorts of annual flowers, and to receive seedlings of former sowings; thus, by keeping up a stock of desirable things, in different stages of growth, the garden may be replenished as soon as the cold season is fairly past.

MARCH.—This being the first month of spring, renders the garden a busy scene, especially if the weather be open; and everything recommended for last month should be continued during the present, with the addition of many other things of equal importance. The bed-flower plants, particularly tulips, must be carefully guarded against sharp frosts following snow or rain; if the state of the ground permit, all the plots and borders may now be smoothed by the rake, preparatory to sowing the first general crop of

hardy annuals. Dahlia-seed may perhaps be sown in pans, and the old tubers placed in dry leaf-mould, on a mild hot-bed, or on a bark bed in a stove, to raise shoots of which young plants are made for flowering. All green-house plants, which flower so readily and so beautifully in the open air in summer, should now, if not done in the autumn, be propagated abundantly by cuttings, on hot-bed heat, so as to be ready for the borders in June. All the different sorts of what are called tender annuals may now be sown in hot-beds, to raise plants ready for potting as soon as they are large enough to handle; all potted flowers, as the auricula, carnation, pinks, stocks, wall-flowers, &c., should now receive their spring top-dressing of fresh compost, to assist them to flower strongly.

APRIL. — The flowers of some of the bulbs have now appeared; those on the auricula stage and on the different beds are coming forward, and require constant care. Tulips and hyacinths will need to be sheltered from wind, rain, or other injurious weather. Many seedlings which have been kept in frames will be fit for transplanting. Another sowing of both hardy and tender annuals may, towards the end of the month, be made to succeed those sown previously. Seedling dahlias, and all the tender annuals, require attention to get them forward. Cuttings of dahlias, and the slips or cuttings of Chinese chrysanthemums, also, must be got forward, by potting singly and keeping them on a little heat, till fairly rooted, and ready to go into other pots, or to their places in the open air.

MAY. — Sow another succession of hardy annuals and biennials, and thin and transplant some of those previously sown. Tender annuals, dahlias, chrysanthemums, &c., lately potted and in frames, must be guarded by mats against the cold of nights, and shaded, till they are well-rooted, from the sun by day; such as are intended to be put out in the open air should be gradually hardened by leaving off the shading, propping, and defending from insects. Carnation-seed may be sown. A small bed of ranunculus may be planted to flower in August, and new beds of violets made. Rose-trees may now be pruned back, to obtain a late bloom; and all other shrubs which produce their flowers on the shoots of the present year may, by cutting back at this time, be made to flower again in autumn.

JUNE. — All serious fears of the effects of night frosts are now over, and therefore all the more tender kinds of flowering plants may be planted abroad with impunity. Dahlias must now, if not done before, be placed in their blooming stations, with stout stakes for their support. The situation should be sheltered, but not shady, and is better if treated with a fresh compost of rich loam and road-sand, well mixed, to grow in. Pot off seedlings if not already done. Auriculas may now be shifted; and tulip, hyacinth, and ranunculus beds may still require attention, to preserve the beauty of the

late flowers, by shading or other care. Carnations now need attention to insure vigorous growth and perfect blossoms. Continue to plant out tender annuals, as well as any green-house plants which can be spared, to add to the gayety of the garden; transplant annuals previously sown and standing too thick; sow biennials, and propagate by cuttings every plant of which a supply may be wanted.

JULY. — Whatever was omitted to be done in June should now be executed without delay. Take up bulbs and tubers when the leaves have withered; sow and transplant annuals to bloom late; propagate pinks, rockets, carnations, &c. Divide auriculas and repot them, keeping them shaded; also, all other plants in pots, as Chinese primroses; propagate pansies by division; sow biennials; prop Chinese chrysanthemums, and lay down some of the long shoots to make bushy plants of the tops. Regulate the patches of previously-sown annuals, and shift those of the green-house or stove. In short, sowing, transplanting, shifting into larger pots, propagating by layers and cuttings, propping, shading, and watering when necessary, form the constant employment of the flower-gardener during this month.

AUGUST. — If any bulbs which have done flowering yet remain in the ground, they should now be taken up, dried, and stored in a safe place. Cuttings of azaleas, ericas, and such similar plants, may yet be put in; those of less woody character, as dahlias, chrysanthemums, geraniums, carnations, pinks, and other herbaceous perennials, may still be rooted. Roses may be budded. Calceolarias intended to flower late should be cut in, and at the same time receive a top-dressing of rich compost. Another bed or two of pansies should be made to bloom before severe frosts set in. Mignonette should be sown in pots and window-boxes, to stand the winter in frames. Cyclamen persicum may now be turned out of the pots in which they flowered, and placed in a dry border to gain strength during their torpid state. Chrysanthemums, dahlias, and all other tall or climbing plants, should have supports. Carnations, whether on stage, bed, or border, neatly tied up and shaded, and layering for next year's stock finished. Seedlings may be bedded out. Shorten the first shoots of the rose-acacia, to cause a second birth of late flowers. Ranunculuses already planted for blooming in October must be kept rather moist, and the soil about them pretty firm. Violets increased by dividing, and place some in a frame for early flowers. Biennials may still be sown, and bulbs intended to flower in autumn planted.

SEPTEMBER. — In this month there is usually much irregularity of growth, decayed flowers, stems and leaves, required to be cleared away, in order that the flower-pots may not present the appearance of wildness or neglect.

Seedlings of biennials and perennials should be thinned, and some of them placed in pots, or transplanted to beds or places where they are intended to remain; all cuttings, pipings, or layers, which are sufficiently rooted, should also be removed to their final or temporary stations. Auriculas should be freed from dead leaves, the earth on the surface of the pots freshened up, a little compost added, and, if any require to be shifted, it may now be done. The seeds of ranunculus and anemone may be sown in pans or boxes, if not already done. Dahlias are now in full beauty; and the Chinese chrysanthemums, whether in pots or in the open air, require frequent watering, not only at the root, but over the leaves, to prevent their flagging under the sun's heat. Seeds of fine annuals, now ripe, should be gathered and saved; and valuable green-house plants which have flowered in the borders should now be repotted. It is now, also, the proper time to prepare the beds intended for tulips, hyacinths, and ranunculuses, in order that they may be properly settled by planting-time; and, indeed, much of the beauty and neatness of a flower-garden the next season depends on the preparation and disposition made at or soon after this time, whether it be in improving the quality of the soil or in altering the forms of the beds; and also many annuals may be sown in pots about this time, to be nursed under glass in the winter, ready to be turned out early in spring. This is a practice which the florist should repeat frequently during the winter months.

OCTOBER. — Dahlias are still in beauty, and only require firm staking against the wind. If any new seedlings have not yet flowered, and are expected or promise to prove excellent, they should be guarded by some temporary covering against being nipped by an unexpected night-frost. Chinese chrysanthemums standing in the open borders are in the same predicament; their flower-buds may be destroyed before they are open, if not protected by some slight covering; those in pots can be removed to a place of safety. Pinks may still be bedded out, and carnation layers potted. These last, together with all other flowers in pots, must be duly supplied with water. About the end of the month, prepare a heap of light and fresh sandy loam, and a sufficient number of proper-sized pots, for the reception of as many bulbs and tubers, such as polyanthus-narcissus, tulips, hyacinths, irises, crocus, &c., as may be required for early and late forcing; prepare also the beds for tulips, hyacinths, anemones, and ranunculuses, to be planted about the beginning of next month. Dig the plots or clumps intended for the hardier sorts of bulbs and tubers, which now require to be put in, namely, narcissus of all sorts, snowdrops, scillas, aconite, &c. Pot roses, Persian lilac, and the different sorts of American shrubs, and other plants proper for forcing. Sow some more pots and boxes of mignonette and other flowers, to go into frames. Perennials may be taken up, parted, and replanted;

SOLE of the more showy sorts may be potted to go into frames, to advance their flowering in spring. Roseries may be pruned and regulated, laying down the long shoots and straggling branches, keeping the whole pretty close to the ground. Standard roses require to be close-pruned and well staked.

NOVEMBER. — The previously planted beds for tulips, hyacinths, polyanthus-narcissus, ranunculus and anemones, should all be planted early. Where these flowers are cultivated in the best style, the collections are named, and require much precision in placing them in the beds; but when executed according to the approved rule, the success is never doubtful. The other business of the season is taking up the tubers of dahlias, marvel of Peru, or others which would be in jeopardy from frost: pruning shrubs, as well to keep them in form as to encourage flowering. All dead or decaying stems or leaves should be cleared off, the ground dug, the patches of perennial flowers reduced, vacancies filled up, edgings repaired, and the whole garden receive a general brush over, laying all as neatly for winter as possible.

DECEMBER. — There is little or nothing to be done in the flower-garden this month. The young seedlings of mignonette, and other flowers in frames, must not be forgotten; indeed, everything liable to be hurt by frost must have sufficient protection. A few more pots of bulbs and tubers, and also another succession of annual flowers, may be sown in pots to go into frames, and be forwarded for planting abroad in the spring.

CHAPTER XI.

RURAL ARCHITECTURE, ETC.

THE CONSTRUCTION OF FARM-DWELLINGS AND COTTAGES — DAIRIES — BARNs
— STABLES — CART-SHEDS AND IMPLEMENT-HOUSES — GRANARIES — CATTLE-
SHEDS — ICE-HOUSES — SHEEP-FOLDS — PIGGERIES — POULTRY-HOUSES — AR-
RANGEMENT OF THE FARMERY — GREEN-HOUSES — FENCES AND GATES —
HEDGES.

I. — FARM-DWELLINGS AND COTTAGES.

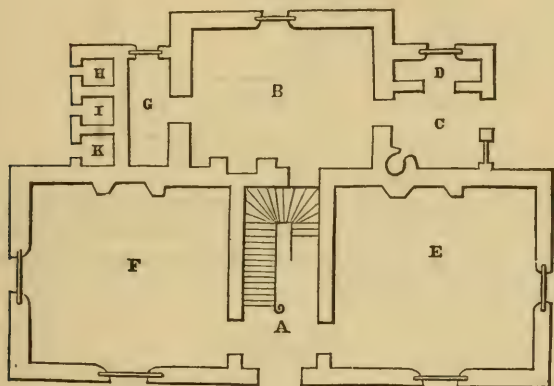
THE edifices of this class which are necessary upon the farm are those intended as residences for the farmer himself, and also for one or more of the persons engaged in the cultivation of it. The character and extent of these are regulated altogether by the extent of the farm, and the taste of its occupier; but even when of the smallest size and simplest construction, the farmer's house should not be deficient in anything essentially requisite for the health, comfort and convenience, of even the most luxurious of mankind.

General Principles to be Observed. — The chief condition to be observed, in the construction of these, is utility; for, in fact, there can be nothing really ornamental, especially about the class of buildings which is now under consideration, that is not founded on this basis; and the size, style, and character of the building, are to be modified according to the pecuniary means available for its construction. As general rules in the erection of farm-houses, it may be observed, that it is always desirable that they should be placed upon a platform or terrace, with a view of keeping the ground floor of the several apartments dry, and consequently rendering them warmer and healthier; that the chimneys should be placed in the interior walls rather than in the exterior ones, this arrangement being better calculated to retain the greatest portion of the heat coming from the fires within the house, and, by the additional heat contained within the central mass of masonry, to make the flues draw better; and that the ground plan should approach as near as possible to a square, as being that form which is calculated to afford the greatest accommodation with a given amount of cost.

Plans for Buildings. — Keeping these principles in view, and accommodating them to the particular situation in which the structure is to be erected, every intelligent farmer will easily make out such a form and arrangement as may suit his peculiar circumstances.

Model of a Moderate-sized Farm-house. — As a model for the construction of a farm-house containing suitable accommodation for a farmer moderately well off, the annexed plan may be referred to. From the entrance and staircase, A, there is a kitchen, B, with back kitchen or store-room, C, and pantry,

Fig. 291.

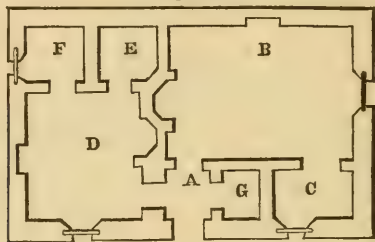


D. There are two good parlors, E and F; a store-room and cellar, G, which may be connected with the kitchen, or entered from the outside, as may be thought necessary. The three small apartments, H, I, K, may be used as store-rooms for some of the smaller implements. It will perhaps be convenient that one of them should be a water-closet, and another may be fitted up as a carpenter's work-shop, in which such jobbing may be done as the persons employed on the farm can do, and thus save the time occupied in carrying the articles to the workman. On the second floor there are three good bed-rooms, one above the kitchen, and the others above the front rooms, with a dressing-closet over the entrance. The apartments on each side of the kitchen have lean-to roofs, and are not carried to the height of the other parts of the building.

Model of a One-story House. — The ground plan of a house consisting of one story only, and calculated for the accommodation of a farmer of quite moderate means, is represented in the following figure. From the vestibule, A, a door leads to the kitchen, B, from which is partitioned off a small bed-room, C. The bed-room, D, has a dark closet, E, and a light one, F. The small apartment, G, may be used as a store-room, in the ceiling of which

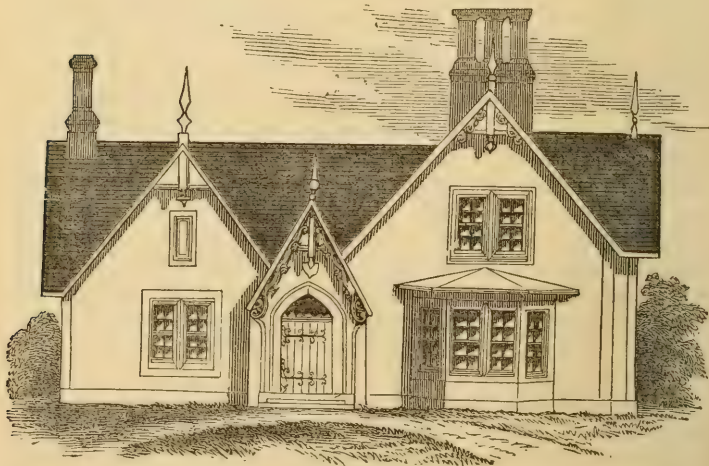
there may be a trap-door, with a suitable ladder reaching to the roof, in which may be two sleeping apartments.

Fig. 292.



Model of a Medium-sized House. — The following design is for a farmhouse of medium size, in which a portion of the front, and the whole of the kitchen part, are of two stories, and the remainder of one story. Fig. 293 is the front elevation of this house.

Fig. 293.



The ground-plan of this structure is seen in the following cut, which may be explained thus: — A, outer lobby; B, inner lobby; C, dining-room; C, closet; D, parlor; d, press; E, passage under the stairs; e, press; F, back

Fig. 294.

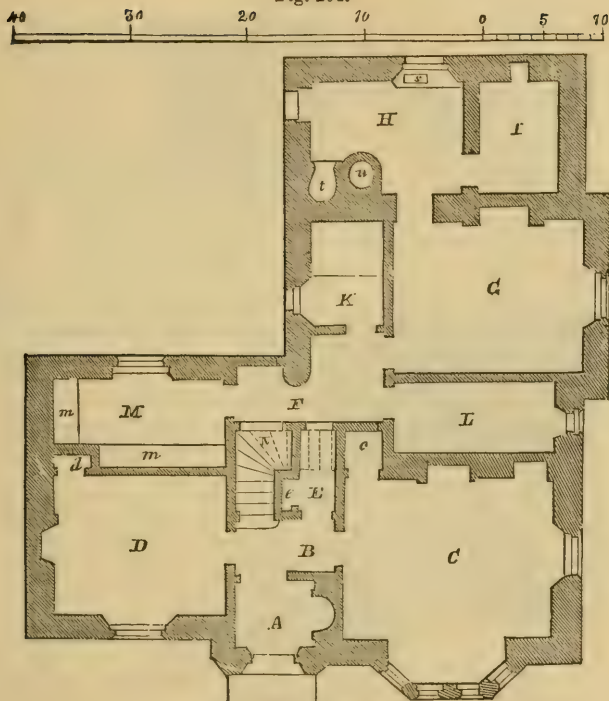


Fig. 295.

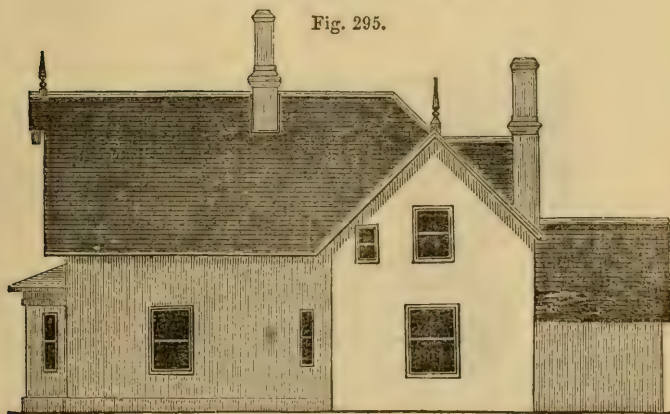


Fig. 296.

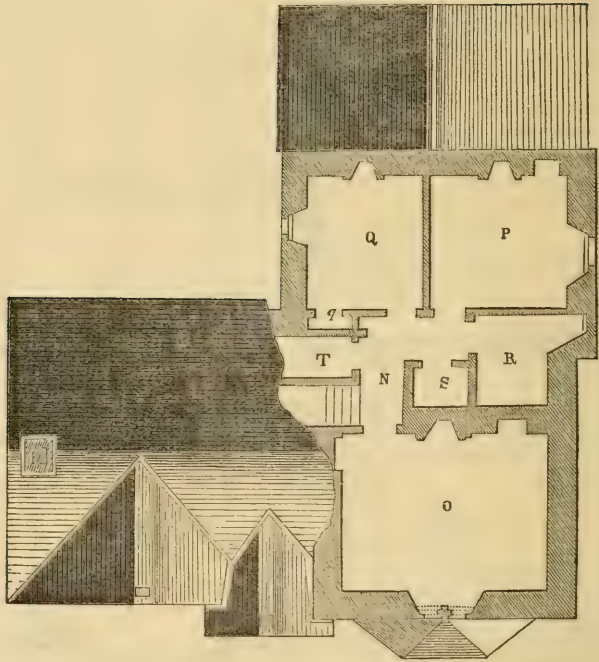


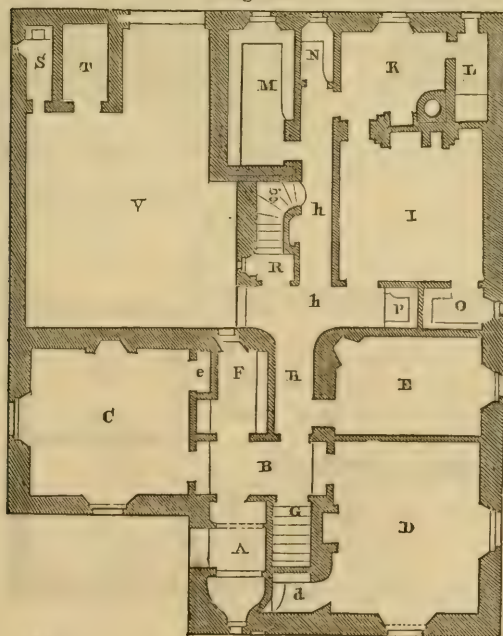
Fig. 297.



Fig. 298.



Fig. 299.



passage; g, kitchen; h, back-kitchen or store-room; s, sink, t, oven, u, boiler; i, coal-house, or wood-house; k, a sleeping apartment; l, store-closet, or pantry; m, milk-house; m, m, stone shelves; n, closet under the stairs, which may be a water-closet.

Fig. 295 represents a side elevation of the same house :

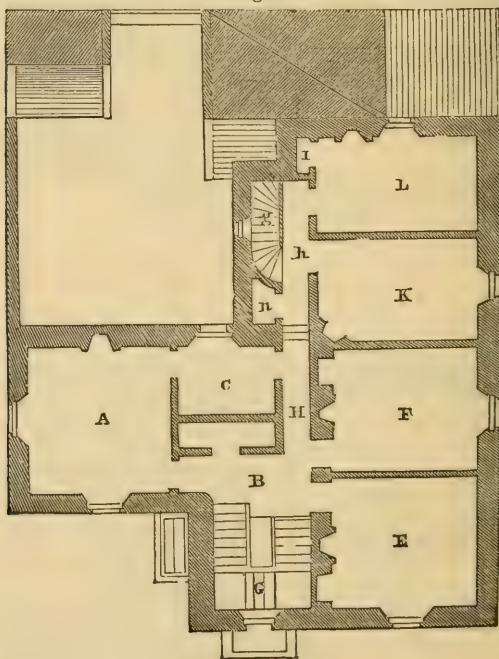
The upper floor, as seen in Fig. 296, may be explained as follows : — n, stair-landing; o, p, q, r, bed-rooms; q, press; s, t, closets.

Model of a Large Farm-house, &c. — The design which is seen in Fig. 297 is for a farm-house of the larger class, in which all the main parts of the building are raised to the height of two stories. First is the front elevation.

A side elevation gives the view as seen in Fig. 298.

The ground plan is represented by Fig. 299, and the bed-chamber floor by Fig. 300, explained in the manner following. In the ground plan, a is the outer lobby; b, inner lobby; c, parlor; d, dining-room; e, business-room; f, store-room; g, principal stairs; h, passage to domestics' rooms;

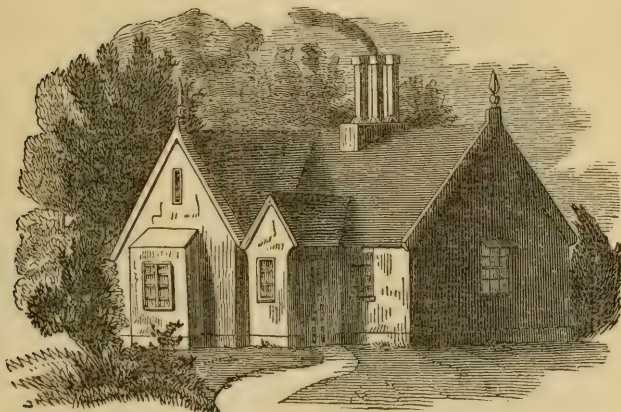
Fig. 300.



h, h, back passage; *g*, stair to domestics' rooms; *i*, kitchen; *κ*, back kitchen; *L*, wood-house; *M*, milk-house; *N*, larder; *o*, pantry; *P*, press; *R*, water-closet; *v*, kitchen-yard; *T*, ash-pit; *s*, water-closet. In the bed-chamber floor (Fig. 300), *B* is the stair-landing; *A*, *E*, *F*, *κ*, bed-rooms; *G*, principal stairs; *H*, passage; *c*, dressing-room, or room for various purposes; *g*, domestics' stairs; *n*, closet; *L*, domestics' room; *i*, press; *h*, landing of back stairs.

The Tudor Style. — Of late years, the fashion of architecture so prevalent

Fig. 301.



in the time of the Tudors, and called by that name, has been revived, even in cottage building, to a great extent, with very pleasing effect. It is, how-

Fig. 302.

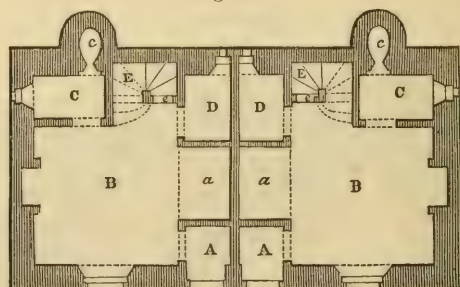


ever, to be borne in mind that this ornamental style is expensive, and therefore not desirable or practicable with those whose object is to provide plain and substantial habitations, at the least possible expense. Fig. 301.

Model of Double Cottage Structure. — Fig. 302 exhibits two cottages in juxtaposition, — a front elevation of the whole structure.

The ground plan, seen in Fig. 303, is constructed as follows: — A, the lobby; B, kitchen; a, recess for bed; c, store-room; c, oven; D, pantry; E,

Fig. 303.



stairs to upper floor; e, closet or cellar under the stairs. The bed-chamber floor is represented in Fig. 304: — F, the stair-landing; G, bed-room; g, recess for bed; H, bed-room; I, closet.

Fig. 304.

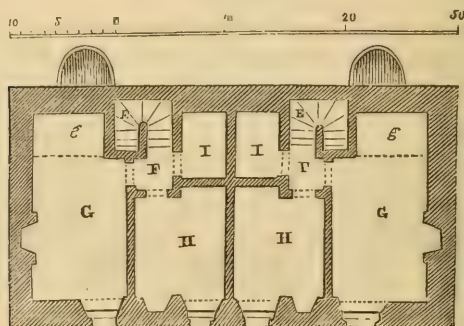
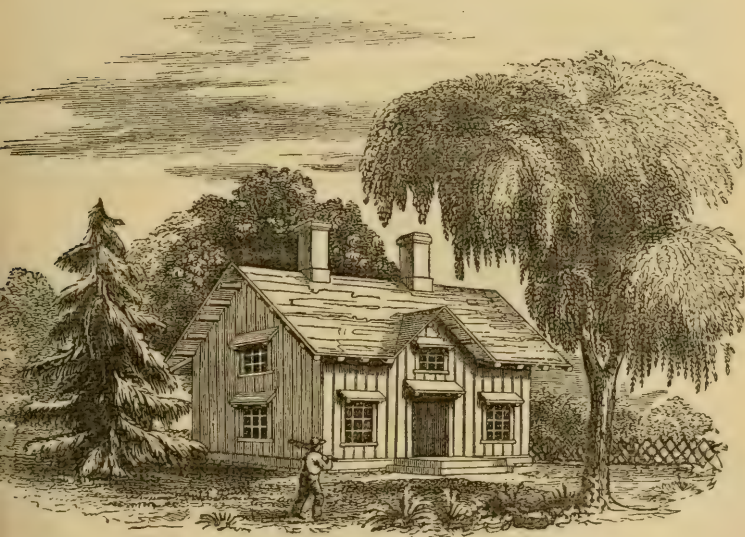


Fig. 302 exhibits the cottage as having a single family-room or kitchen, on the lower floor, and sleeping apartments above. However limited this accommodation may seem, it is fully equal, if not superior, to that enjoyed

by thousands of cultivators of the soil in this country, and incomparably superior to what is enjoyed by multitudes in the old countries. If we shall make use of the kitchen for containing a bed, it gives three distinct rooms for sleeping, with a small closet which may be used for the same purpose. But the cottage, in place of containing one room below, may contain two, in which case it will become more commodious.

Modifications of Plans. — With regard to the architectural design of the cottage, it has not been deemed necessary here to do more than show such an elevation as arises from the plan itself. But the architectural design may be modified in any way. By giving a porch, by making mullions to the windows, by causing the eaves to project, and by enlarging the chimney-stalks, a more graceful exterior may be produced. A just taste will lead the designer of the cottage, as of every other building, to make even its architectural decorations in harmony with its known uses. A solid and

Fig. 305.



warm dwelling, suited to the wants and conveniences of rural life, is what we should desire the cottage to be; and the taste will be best gratified when the architectural characters of the building are seen to be in accordance with these ends. The parts of the cottage on which the art of the designer

might be appropriately shown are those just referred to. Fig. 305 represents a very neat sketch of a cottage of moderate size and cost.

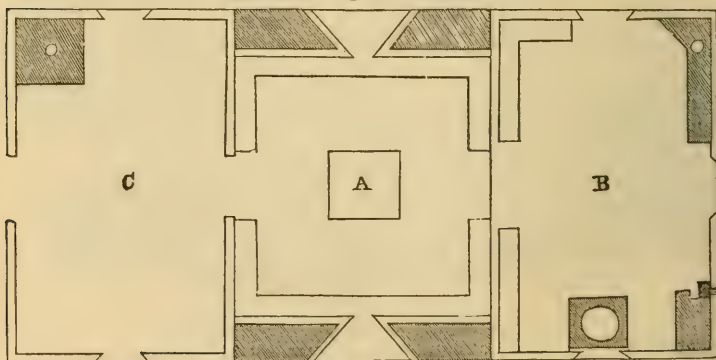
II. DAIRIES.

General Remarks. — On proper attention to the construction of the dairy-house materially depends the perfect manufacture of cheese and butter, and nothing should be spared in rendering it as complete in accommodation for the different operations as the nature and size of the farm will admit. We allude not to the elegance of many gentlemen's dairies, nor to some few of those fitted up at great expense for a large business, but to those upon a moderate scale, and in every instance where the object is not confined to the mere consumption of the family. It is, indeed, the more necessary to remark upon their deficiencies, and give some hints towards remedying them, as many of them consist of nothing better than an out-shed attached to the kitchen, and very few are erected with a proper degree of judgment.

Different Apartments of the Dairy-house. — The apartments which are peculiarly appropriate to the dairy-husbandry are, one for milk; another for butter in churning, or for scalding, pressing, and salting cheese; and a third for implements, over which, in cheese-dairies, a store-room may be placed under the roof.

Site. — The building, though placed conveniently to the house, yet should be apart from any immediate contact with the odor of the farm-yard, or other impurity, as well as from any pond of stagnant water, as nothing more

Fig. 306.



readily acquires an unpleasant taste or smell than milk and cream. A uniform temperature being also of extreme importance, the site of the structure should be such as to be as little as possible affected by the

extremes of either heat or cold. The most experienced dairy operators disagree respecting the degree of temperature most suitable to the production of cream and the making of butter; but they all admit that the house cannot be rendered too cool during the summer, and in winter it is easy to keep up a sufficient warmth. It is recommended by some of the most skilful that the main aspect be open to the north and east; and the building should, if possible, be shaded, either by other walls or by high trees, from the south and west. The roof should be of a high conical form, or what builders call a "span roof," rising from the centre, and projecting downwards broadly over the sides, to shade the body of the house, which should consist of a narrow range of rooms, upon the plan of Fig. 306.

To secure a Proper Temperature. — Of the apartments represented in Fig. 306, the middle — that in which the milk is preserved — is the most important; and, therefore, in order to secure as equal a temperature as possible at all seasons of the year, by excluding all direct communication with the external air, the outer walls — as marked black in the plan — should be made of sod and earth rammed firm to the breadth of full four feet in thickness, while the other walls of the building need only be constructed of a single brick, or even with lath and plaster, boarded on the outside; nor is it necessary that they should be more than seven or eight feet high at the sides. A funnel should also be run through the centre of the roof to a couple of feet above it, to act as a ventilator, — a valve being fitted to it, which, by means of a pulley, can be shut or opened at pleasure; or it may be ventilated in a more purely scientific, and perhaps much better manner, by means of the recently invented and approved apparatus now so much in use.

Arrangement of the Apartments. — The arrangement of these rooms will therefore be thus: — A, the milk-house, with broad shelves all around, for holding the vessels which contain the milk and cream; and in the middle is a table for preparing the butter for market. The windows are closed with lattices covered with gauze wire, to prevent the entry of flies, and double shutters of wood, to guard against cold in winter; or common windows with single shutters will do. B, the churning-house, with a boiler in one corner, and on the sides frames for cheese presses and vats, with large vessels of lead, slate, wood, tin, or earthen ware, for holding the whey, and pipes for conveying it to a cistern outside, for the use of the pigs. C, the wash-house for the cleansing and care of the utensils; it therefore contains a furnace with a cauldron for scalding the vessels, and a pump communicating with a well. The outer door or entrance is here, and adjoining it are placed stands under the verandah formed by the projection of the roof, for exposing all the wooden implements which may have been washed to be dried and sweetened by the sun and air.

Store-loft or Upper Rooms.—In cheese-dairies, the store-loft may be placed immediately below the rise of the conical roof, — a communication being made by a stair-case in a corner of the wash-house, — but many farmers prefer having the loft over the cow-house, with the intention of forwarding the maturity of the cheese by its warmth. Some large dairies, however, have roofs in the common form, with lofts and sleeping-rooms over them; and others, of a moderate size, have the milk-house sunk about three feet below the ground, with very thick brick and rubble walls, standing ten feet high, thus admitting of a cheese-loft above. The buildings in the latter case are also constructed differently from that already described, — the milk-house having three fronts encircled by a verandah, — thus affording a strong draught of air through the windows, with only one door, while the other rooms are of timbers rising up to the roof, and the wash-house forms the only mode of communication between both. The plan, on the whole, has the advantage of having the milk-house entirely separate from the churning and scalding room, as well as of its being somewhat cooler in summer; but what it gains in the latter respect it loses in the constant equality of temperature, and its construction is more costly.

Model of a Complete Dairy. — In Figs. 307, 308, a design is given of a

Fig. 307.

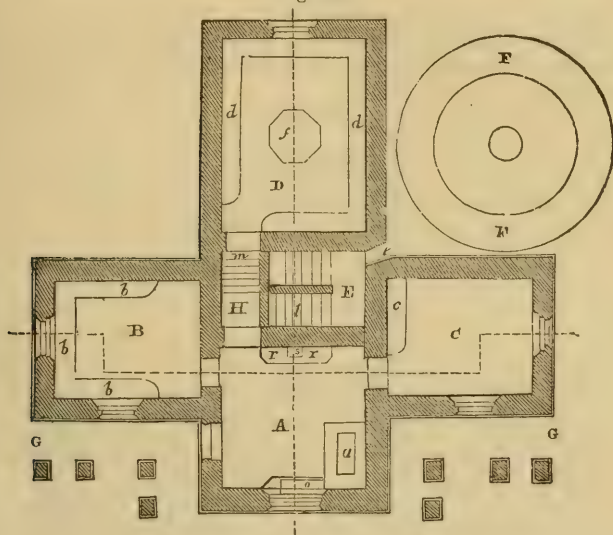


complete dairy, which may either form a part of the farmer's house, or be distinct from it. The front elevation is as above.

The plan of the ground floor, as seen in Fig. 308, is as follows: — A is the scullery; *a*, steam boiler; *o*, sink in the window recess, in which the water can be heated by a steam-pipe from the boiler; *s*, small sink commu-

nicating with the pigs' troughs, in which the whey and other refuse are thrown; *r, r*, stone benches, on which the milk-pails are placed before they

Fig. 308.



are put into the milk-room; *E*, wood and coal cellar, with hatch, *e*, by which the fuel is thrown in; *C*, churning-room; *c*, stone bench for milk-vessels;

Fig. 309.

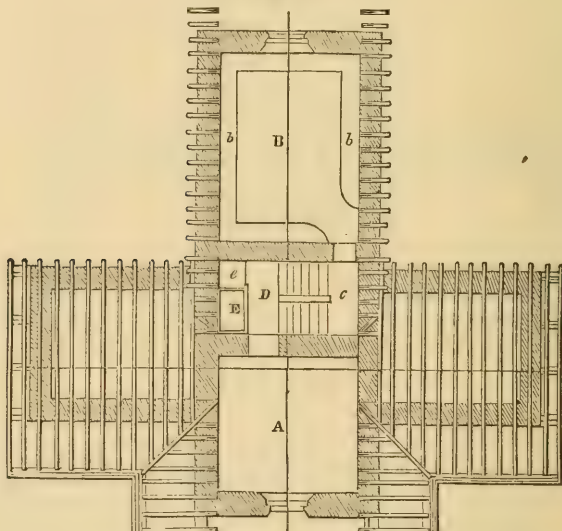


B, cheese-making room; *b, b, b*, stone bench, for utensils; *D*, milk-room, *d, d*, stone bench round the room, for milk-vessels; *f*, table for prepar-

ing butter, with basin and fountain ; G, G, shed along the front of the building, for drying dishes ; F, F, horse-course for moving the churn ; H, passage from scullery to milk-room ; *m*, stairs down to milk-room ; *l*, stairs up to loft.

Fig. 309 gives a side elevation view of the building. The plan of the upper floor or lofts, represented in Fig. 310, is thus explained :—A, the

Fig. 310.



store-room over scullery ; B, store-room over milk-room ; *b, b*, shelves ; *c*, landing of stairs ; D, upper landing ; E, cistern ; *e*, closet.

III. BARNS.

Plan of Apartments.—On tillage farms, where grain is produced in large quantity, the barn is an important part of the buildings of the farm ; but on farms where pasturage is almost exclusively practised, the barn becomes less necessary. In the construction of barns a great change has taken place since the introduction of the threshing-machine. They were formerly constructed of dimensions capable of holding the greater part of the produce of the farm. When the flail is used in the operation of threshing, the barn usually consists of a plain oblong building, without any internal divisions, and of a size proportionate to that of the farm. It is made to hold one stack

of corn at a time, and besides the space occupied by the corn, room must be left for the threshing-floor, on which the grain is placed for the action of the flail. An essential circumstance in the arrangement of the barn, in this case, is the formation of the threshing-floor of suitable materials, and in a convenient situation. It is, for the most part, placed in the centre of the building, but it may be laid down in any other part that may appear more convenient. In the construction of these floors, wood, when properly laid and put together, is probably the best, and the most secure from damp, and may be arranged so as to be moved at pleasure. The dimensions may be from twelve to fourteen by eighteen or twenty feet. The materials should be well seasoned previously to their being put together, in order to guard against shrinking afterwards; and it is to be observed that the platform thus made is to be slightly raised above the other parts of the floor.

When the threshing-machine is employed, the barn is conveniently divided into a number of apartments, to facilitate the work in the operation of threshing, and to enable the unthreshed corn to be kept separately from the grain and straw. The barn for threshing consists of two apartments, one above the other. In the upper apartment is placed the unthreshed corn, as it is brought from the stack; and in the event of the farmery being placed in an inclined situation, advantage may be taken of this circumstance, by placing the entrance to this apartment in the same plane with the surface of the ground outside, which secures ready ingress and egress with the corn. The threshing-machine is placed at one end of this apartment, and it extends to that below. In this apartment also is placed the table on which the sheaves are spread out, and the feeding-board at which the person stands who supplies the corn to the machine. The lower apartment is called the dressing-barn, as the grain is received in it from the threshing-machine, and is there winnowed and prepared for use. The remaining apartment connected with the barn is that in which the straw is received as it falls from the machine, and when it is stored up for use. It should be of sufficient size to contain the produce of one stack, at least; and it is desirable that it should be even larger, so that straw may be preserved dry, after being threshed in severe weather.

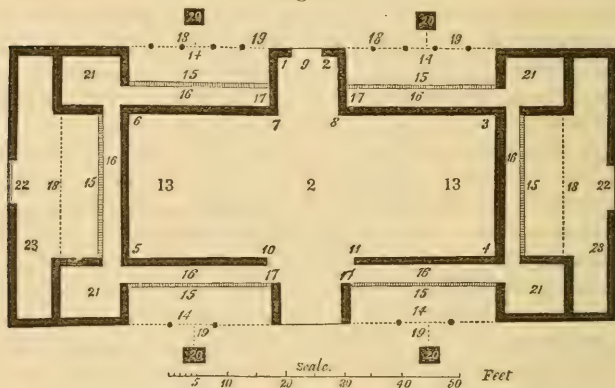
Light and Air.—In the construction of the barn it is important that arrangements be made for ventilation and the admission of light. These objects are effected by glazed windows, consisting of two sashes, so that they may be moved up and down, or by means of what are termed luffer-board windows, or such as are formed of small slips of wood, instead of glass.

To prevent the Depredations of Vermin.—The floors should be formed or arranged so as to prevent the depredations of vermin. These frequently make passages into the space below the boards along the edges of the floor-

ing between it and the walls; but this may be prevented by skirtings of thin sheet-iron placed around the apartments, and so formed as to overlap the floor an inch or more. The joining of the skirting with the wall is to be well filled up with mortar, and the lower part is to fit accurately to the floor.

Model of the Washington Barn.—The following is a sketch of the barn structure sketched by Arthur Young for General Washington, explained thus:—1, 2, 3, 4, 5, 6, the barn; 1, 2, 7, 8, the porch of do., with a small

Fig. 311.



door at 9; 10, 11, the great door at which the carts enter; 12, the threshing-floor, which extends the space of 1, 2, 10, 11; 13, 13, bays, in which the corn is stowed; 14, 14, 14, 14, sheds for cattle and horses; 15, 15, 15, 15, mangers, out of which the cattle get their roots, straw, and chaff; 16, 16, 16, 16, passages, between two and three feet wide, for carrying food to the cattle; 17, 17, 17, 17, doors into the passage; 18, 18, 18, 18, principal posts on which the sheds rest; 19, 19, 19, 19, gutters of bricks sloped for conveying the urine of the cattle to 20, 20, 20, 20, cisterns, from which it is every day regularly thrown on the dunghills, or made use of otherwise; 21, 21, 21, 21, sheds for various uses; 22, 22, two yards, with each a shed for shelter, to be applied to any purpose wanted—one for sheep, surrounded with low racks—another divided for a horse or two, loose, or the other half for yearling calves; 23, 23, enclosure of pales; 1, 2, 8, 3, 4, 5, 6, 7, the main body of the barn, which rises from fourteen to twenty feet to the eaves, all the rest of the shed being placed against it. The quantity of cattle room may be enlarged by a slight extension of the sheds at each end; and all these points may be made to vary according to the views, circumstances and wants, of each farmer.

Buel's Barn. — The figure below is the ground-plan of a barn according to Buel's views; *a* is the barn-floor, fourteen feet wide; *b, b*, bays for hay

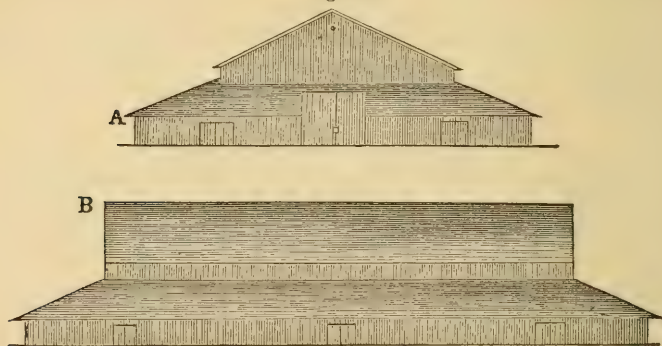
Fig. 312.



and grain, eighteen feet wide and ninety-two feet long; *c, c*, stables for cattle and horses, thirteen feet wide in the clear; *d, d*, passages to stables, four feet wide; *e, e*, mangers for feeding, two and one half feet wide; *f, f*, great doors, fourteen feet wide; *g, g*, stable-doors, five feet wide, double. Length of barn, one hundred feet; width, fifty feet; posts, eighteen feet; pitch of roof, twelve and one half feet; height of lean-to posts, seven feet; pitch of stable-roof, eight feet; length of side lean-tos, one hundred feet; length of end lean-tos, thirty-eight feet. The end view (A) and the side view (B) are seen in Fig. 313. The barn is framed as if to stand alone, omitting the lower girt at the ends on each side of the large doors. The lean-tos are then framed on to the barn in the simplest manner, the passage being round the main body of the barn, excepting at the ends, where the passage is in the main barn, and the lean-tos there only sixteen feet wide,

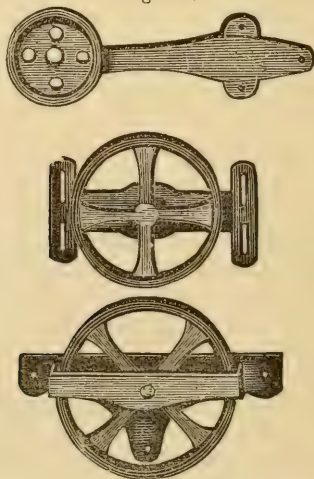
and the manger is fitted up to the main barn. Only one passage is made to go into the short stables at the ends. Stalls are made seven and one half

Fig. 313.



feet wide, and boarded between; and each ox or cow is tied next to the partition side of the stall, which prevents their getting together, and saves much room. The doors are sufficiently wide to drive in a pair of oxen

Fig. 314.



yoked, and large spikes are driven in the plates all round the stables, to hang harness, yokes, and chains upon. The bottoms of the mangers are raised

ten inches from the floor and laid double: the sides of the stable are also battened with thin boards inside, which makes them perfectly tight and warm; windows, with sliding shutters, are made in the sides, to throw out the manure. Girts run parallel with the main floor in the posts, across which are laid poles, nine feet above the floor, on which hay or grain can be piled up to the peak. This barn will hold two hundred tons of hay, and forty-six yoke of oxen, or one hundred cows or horses. If only ordinary stock is kept, the *long* lean-to need be only eighteen feet wide, and the short ones fourteen feet. Granaries can be partitioned off from the bays or stables, as may be convenient. If a threshing-machine is used, a part of the stable can accommodate it. On this model barns of any size may be built. The improved barn-door roller, of which we give samples, ought to be used by every barn-builder. (Fig. 314.)

IV. STABLES.

Site. — Stables should be placed in such a position that ready access may be had to them, without the necessity of passing through courts or yards where any animals are kept. They may have a court in front for containing the dung and soiled litter; but it is better that they be contiguous to the yards where the cattle are kept, so that the dung may be mixed with that of the other animals. If circumstances allow, there should be an adjoining cistern for holding water. It is better, for the regularity of superintendence, that all the farm-houses be under one roof, and, if more than one stable is necessary, that all the stables be together.

Light and Air. — The essential point, in the construction of the stable, is to afford sufficient cubical space for air and ventilation, and sufficient area for the animals and the workmen who attend them. The most suitable breadth for farm-stables is eighteen feet within walls, though sixteen will do, and seventeen may be regarded as a convenient medium. There is no great objection to the extension of the breadth of stables and other buildings, except the expense of roofing, which, from the greater size of the timbers necessary, increases in a great proportion with the extension in breadth. The whole space should be left free to the roof, no lofts of any kind being suffered to be erected above the horses, so that the benefits of sufficient space and ventilation may be secured in the fullest degree. No point is more necessary to be attended to than this, in the farm-stable occupied by a great number of animals.

The proper manner of ventilating stables, as of all apartments where animals are kept, is by openings at the ridge of the roof, by which means the heated vapor of the stable is suffered to escape. If these ventilators are of the proper number and size, there is no need of apertures in the walls, as

some recommend, and seem to think necessary. We may be certain, that if we allow the heated air to escape above, the colder will descend to occupy its place. The air within the stable will, indeed, be kept above the medium temperature without, but in no such degree as to injure the health of the animals. It will suffice, when the horses are out of the stables at work, to open the windows and doors, so as to remove the effluvia which have been evolved from the dung and litter; and, in warm weather, the windows may be opened when the horses are feeding. The ventilators may be formed by frames with louver-boards, inclining so as to prevent the entrance of rain. But they may be simply and conveniently formed by making openings on each side of the ridge, defended from the weather by the roof-boardings and the ridge-lead. The windows of the stable may be formed with a glazed upper part, and sliding frames, below, as in the case of those of the granary.

Stalls. — Each horse should have his own stall, which should be six feet wide. Horses are always reluctant to lie down when they have not sufficient space, and many will scarcely lie down in the stable at all. The partitions of the stalls should be eight feet long, five or six feet high behind, and seven in front. They are almost always formed of boards mortised into posts, one near the wall, and one at the other end of the partition. The hinder post may be sunk deep in the floor, and be of the height of the partition, or it may be carried up to a beam extending along all the stalls; this last method of construction is both substantial and adapted to the long line of stalls in the stable, and in this case, also, the hinder posts are not sunk into the ground, but let into stone sockets.

Racks and Mangers. — The horse receives his food from racks and mangers. The rack may either be elevated above the head of the horse, or rest upon the ground. In the former case, the horse pulls down his food in mouthfuls, and this is attended with less inconvenience than, from the awkward position of the racks, might be inferred. In this way, too, it is generally believed that there is less waste of hay than when the rack is on the ground. But, however this may be, this species of rack is found sufficiently suitable in common practice: It consists of two horizontal rails, into which are fixed upright pins, slightly inclining outwards from the lower rail. The pins may be two inches in diameter and three inches apart, and the lower rail may be four feet six inches from the floor. This rack should extend the whole width of the stalls, and the slighter the inclination given to the upright pins, the better. It is common to make smaller racks of iron, projecting from the wall. The upper rack, for hay, does not supersede the propriety of having a lower one, for straw and green forage, which are best supplied from a low rack. It has been often proposed that racks shall be altogether done away with, and the horses fed entirely on cut straw and hay, mixed with farinaceous food.

There is an apparent economy in this practice, but experience shows, that, in the case of the farm-horse, it is better that there be a system of racks, in which food is placed before the animals at all times.

The manger is an oblong box, open at top, and placed at one side of the stall. Its dimensions may be fifteen inches wide at top, twelve inches at bottom, and nine inches deep. In this box the corn of the horse is placed at stated times, and in a given quantity; and when boiled or prepared food is given, it is likewise placed in it. The system of partially feeding horses with prepared food, as potatoes or turnips boiled, mixed with farinaceous food, is an excellent one. To suit this method of treatment, the manger should be of sufficient capacity, as of the dimensions above stated, and two and one half feet long. What is not occupied by the manger is occupied by the lower rack. The outer edge of both the manger and rack should be formed of a continuous bar of stout wood, three inches thick, and four inches deep. Into this bar is to be fixed a ring, through which is to pass the end of the halter which attaches the horse, with a little iron weight at its extremity, to keep it tight. Often, however, though not so properly, the end of the halter is merely tied to the ring.

V. CART-SHED AND IMPLEMENT-HOUSES.

Site, &c.—The injurious effects of the exposure to the weather on structures of wood are well known, and they have suggested the utility of placing the carts and other implements of the farm in situations where they would be free from exposure. The carts and larger implements are usually placed in sheds open in front, but defended on all other sides. The circumstances to be attended to in their construction are to place the open side in that direction which is most sheltered, and to preserve the implements in it from rain. It is not, however, necessary that the whole of the apartment should be devoted to that purpose, and it has accordingly been found an economical arrangement to have the granary, or some other store-room, above the cart-shed. Connected with the cart-shed there may be some apartment for holding the smaller implements, which is to be secured by a door and lock. One part of it may be devoted to the carpenters' tools.

VI. GRANARIES.

Site, &c.—Among the buildings used as repositories, the granary may be mentioned; but, except on the larger class of farms, a separate building will not be necessary for holding grain. The most convenient situation however, for the granary, is above the cart-shed. In barns with threshing-machines, it is sometimes formed immediately above the floor on which the machine works, which admits of the corn being immediately raised to it

from the ground-floor, either by the threshing-machine itself, or by a windlass, easily worked by one man. In this case, as well as in every other in which the granary is placed over another building, it is always convenient to have a windlass to it, either immediately over a trap-door in the floor, or over a door in the outside wall.

VII. ICE-HOUSES.

Necessity for.—In a climate like that of the United States, ice is indispensable in summer—contributing alike to the comfort, health, and convenience of all who use it. In the cities it can always be readily obtained from those who make a business of securing a supply at the proper season, and preserving it for sale in sultry weather; but in the country no such facilities exist, and each individual farmer must either lay up a sufficient stock during the winter months, or suffer a deprivation of those cooling and refreshing beverages which can only be concocted with the aid of ice. To preserve ice properly, it should be stowed in a repository specially constructed for the purpose, somewhat like that described below.

Mode of Construction.—Select and mark off a piece of ground twelve feet square, and excavate it to the depth of twenty feet, sloping the sides as they descend, until, like an inverted pyramid, they meet in a point at the centre, when they may be faced with brick, or rubble mixed with Roman cement, which will soon form a solid wall. At the bottom sink a well down to gravel, and fill it in with loose stones—thus supplying an outlet for the water which may accumulate. Cover the whole with a double board roof, rising to a point, and leave between a space of three inches, which may be filled with straw, tan, or powdered charcoal. A more durable roof may be constructed of brick, but the first cost will be greater. Place the entrance on the north side, and let it open into a porch, six or eight feet long, closed by a tightly-fitting door at each end; and protect the house from the sun's rays by planting trees around it on all sides. Pave the surrounding ground with brick to the distance of some feet, giving it such a pitch as will carry off all rain-water.

Filling with Ice.—Cover the sides and bottom with straw, to prevent the ice from coming in contact with the brick-work, and pack the ice as tightly as possible. If the weather is very cold, and the ice sawed out in squares, this may very readily be done; and, water being poured in between the pieces, the whole will quickly become a solid mass. When the house is filled, cover the ice with straw to the depth of three or four inches, over which lay boards or plank, to keep all snug.

VIII. SHEEP-FOLDS.

General Remarks.—A considerable quantity of manure may be saved by folding sheep at nights during the winter months, though such practice would be injurious in warm weather. As a general rule, it will be found that sheep carefully sheltered from the severe weather of winter, will be in better condition, and their wool finer and softer, than if left exposed to the chilling blast and pelting storm. The sheep-fold is an important addition to the fixtures of a farm, more particularly of one specially devoted to sheep husbandry.

Arrangement of Sheep-Folds.—Enclose three sides of a piece of ground with a shed eighteen feet wide, twelve feet high on the inside, and five feet high on the outside, which must be weather-boarded on the outside, and also on the inside, to within five feet of the ground. At each angle construct a building—one for hay, and the other for roots—with doors opening under the sheds, for the more convenient feeding of the sheep. Make the root-house walls and roof double, and fill in the space with some non-conductor, to prevent the roots from freezing; but be careful to secure proper ventilation by means of a flue, closed with a slide. Guard the open side of the square from intrusion by erecting a neat fence across it, and give the ground under the sheds a sufficient slope to carry all moisture into a gutter, running round the whole plot, and emptying into a pit on the outside.

Feed-Racks and Troughs.—Place the racks in a line, facing the open part of the sheds, leaving a space between them for the sheep to pass in and out; and make each rack of a single plank, twenty feet long, twelve inches wide, and at least two inches thick, into each edge of one side of which, rounds three feet long may be so inserted as to incline outward at the tops, where the distance between them will measure three feet. Leave a space of five inches between each round, and set in two or three at each end, to prevent the sheep from jumping into the racks while feeding. Mount each rack upon four substantial legs, two feet high, giving them a sufficient spread to guard against their sinking into the ground, or being overturned. Place the troughs in a position convenient to the root-house, and make them of plank; giving a length of twenty feet, a width of twelve inches, and a depth of four inches, to each. Over each trough fix a plank on supports, rising from each end, and tenoned to fit into mortise-holes in the plank. A long nail passing through each tenon will keep the cover firmly in its place, and thus the sheep will be prevented from jumping into the troughs, and soiling the food. Before the hay-racks are filled each day, the sheep must be turned out of the yard, to keep them from getting seed in their wool; and if the

racks are well filled in the morning, each will feed 100 sheep during the day. One filling will be sufficient, provided the sheep can pick up a little grass, or they are fed with some other kind of green food. They must be well supplied with water, which may be readily done by means of a pump and long trough. Salt will also be frequently required.

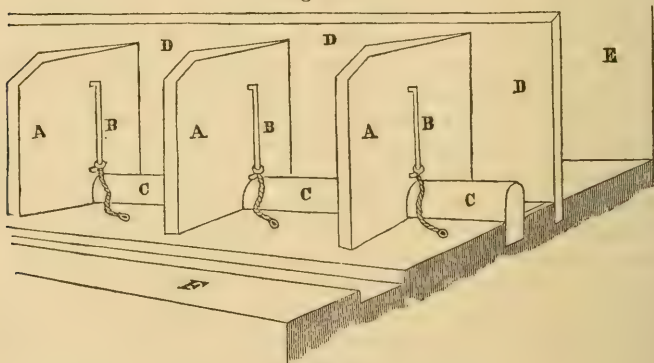
IX. CATTLE-SHEDS.

Uses and Requisites.—Cattle-sheds are used either for lodging milch cows or young cattle, or for stall-feeding for the butcher. The principal requisites, in buildings of this description, are to be capable of being properly ventilated, to be constructed so as to require the least possible labor in feeding the cattle and cleaning away the dung, and to have the stalls so formed as to keep the animals dry and clean, with sufficient drains to carry away, and reservoirs to collect, the urine and dung.

Arrangement of Cattle-sheds.—The common method of arrangement in these houses is to place a long beam of wood, about five feet high and two feet from the wall, at the heads of the animals; and to this beam the posts are fastened to which the cattle are attached. The usual distance of these posts is about four feet. A movable ring is placed round each post, from which a chain is extended round the neck of the cattle, and they feed from a low manger or trough, formed merely of a raised edge of stone or wood, between which and the wall the food is placed.

A more perfect arrangement is now adopted. This consists in placing

Fig. 315.



the heads of the animals at such a distance from the wall as to leave a narrow pathway in front, by which the food can be more easily placed before

the cattle, and placing each animal in a separate stall, the stalls being divided by low partitions, just of sufficient size to prevent them from interfering with each other. A movable ring and chain are also here used for attaching the animals, the ring being, in this case, moving on a vertical rod, instead of the wooden post. This arrangement is represented in Fig. 315. A, A, A, are the partitions between the animals; B, B, B, the upright iron rods, to which are fixed the rings and chains by means of which the cattle are tied; C, C, C, represent the raised edges, or curb-stone, of the manger in front; D, D, D, the partition separating the manger from the pathway by which the food is conveyed to the stalls; E, the pathway in front; and F, that behind the animals.

In the internal arrangement of cattle-sheds for cows or oxen, the animals may be made to stand either across or along the building. When ranged lengthwise, the width of the house should be, at least, sixteen feet, and the space allowed for each of the animals of the larger kind should be six feet. The distance from the manger to the wall, being the passage for carrying along the food, may be four feet, to admit the attendant to supply the animals with their food with facility. A distinguishing feature in the arrangement of houses in which cattle are tied up is the open gutter behind, which is rendered necessary on account of the comparatively fluid nature of the animals' dung. The space between the manger and gutter is regulated by the size of the animals which are to occupy the stalls. The gutter is generally made a foot broad, and three or four inches deep, and it is usually made perpendicular in the sides.

The organization of cattle being less delicate than that of the horse, they are not so liable to suffer from vicissitudes of temperature as that animal, and the same precautions for maintaining an uniform temperature in their houses are not necessary. Complete ventilation is, however, essential; and, to secure this object, milch cows, as well as young cattle, are frequently placed in open sheds, care being taken that the open side of the shed is sheltered from the elements.

The most convenient arrangement, especially in the case of the larger-sized animals, is probably that in which they stand lengthwise in the house; there being a space in front of the mangers for carrying along the food; a passage behind them in which the attendant stands in cleaning them out, and from which he supplies them with litter; a gutter communicating with a reservoir, from which the dung and urine are conveyed, as occasion may require. This arrangement is simple and efficient. The animals are supplied with food, and cleaned out with facility; but this is not the only plan of arrangement by which these objects may be effected. A cow-house, or cattle-shed, in which the animals stand across the building, will afford the

same accommodation as that in which they stand with their heads against the side wall, at less expense of walling and roofing, for the passages before and behind serve for the accommodation of two sets of cattle.

Calf-houses. — The calf-houses are to be placed convenient to the cow-houses, to lessen the labor of carrying the milk to them; but they should not be so near as to permit the cow to see or even hear her calf, if possible. In the construction of these apartments, the chief requisites are to secure cleanliness and a proper degree of heat, and to guard against dampness, which would be injurious to the young animals. To effect the latter purpose, the floor may be raised some distance from the ground, and formed of laths or bricks, placed in such a manner as to allow any liquid matter to pass through; and this artificial floor is to be raised so high above the surrounding surface as to admit of the intervening space being cleaned out occasionally, otherwise it would become a receptacle of filth, producing the most offensive exhalations. The litter is thus kept dry under the calves; but it must not be allowed to accumulate for a length of time, for the mass thus formed would prevent the moisture from getting through.

The interior arrangements of calf-houses are sometimes similar to those described, and they are, in fact, cow-houses in miniature. A more simple and equally convenient arrangement consists in placing the calves in separate divisions, each having a manger or crib for holding a small quantity of hay, or young grass, according to the season. The partitions between the calves should be so high as to prevent their reaching over to one another; for otherwise they suck each other's ears, and often suffer from lumps of matted hair being thus conveyed to the stomach.

The feeding-cattle may have houses of the same construction as those described; but they may also be fed in yards with sheds attached to them, to which they can retire during the night, or in stormy weather.

Apartment for Boiling Food, Apparatus Necessary, and the Mode of Proceeding. — Connected with the cattle-sheds and feeding-yards, there may be an apartment for boiling or steaming food, in which a steaming apparatus is placed. Any kind of wooden box or barrel will answer for this purpose, so formed as to be readily filled and emptied. The steam is to be conveyed in a pipe to the lower part of the vessel, which ought to have a sliding board at the bottom, to allow the contents to be discharged when ready. The vessel may be filled with water, though this is not necessary in the case of succulent roots, as the potato and turnip, because the steam is quickly condensed. But when corn is to be boiled, it should be covered with water, to effect the condensation of the steam. An apparatus of this construction is represented in Fig. 316. It consists of a furnace and cast-iron boiler, A, furnished with a safety-valve, to render it secure from danger,

even in the hands of the most inexperienced person. This boiler may be made to supply warm water for other purposes in the farmery, the water being drawn off by a cock in the lower part of it. It is supplied with water

Fig. 316.



from a cistern, B, placed at the height of five or six feet above it. When filled, the cistern requires no further attention, as the boiler regulates its supply of water by means of a float inside, attached to the valve in the cistern. Two casks, C and D, are intended to hold the potatoes, turnips, or other matters to be steamed. The steam is conducted to these from the boiler by a pipe branching off to each by stopcocks. As many casks as may be necessary for the supply of food may be attached in the same way. These, it has been said, are furnished with sliding hatches in the bottom for taking out the food when ready, and are raised as far from the ground as will admit a barrow or trough to be introduced under them, to receive the contents when they are ready to be withdrawn. For boiling grain, the cask for holding it differs from those used in steaming roots only by not having a hatch in the bottom, as the hatch could not be easily made tight, which is necessary in this case, as water must be mixed with the grain in the same quantity, or nearly, as if it were to be boiled in a boiler in the common way. It may be added, that the hatch not being tight in boiling potatoes is an advantage, and even necessary for allowing the condensed steam to run out, and also all the earthy matters from the skins of the potatoes. In the figure, one of the casks is represented with the lid pressed down by means of the vertical bar, which is employed for this pur-

pose during the operation of boiling or steaming. In the other cask, the lid is represented as opened, with the vertical bar removed to one side.

There is a steaming apparatus of an improved construction in use, consisting, like that already described, of a metal boiler with safety-valve and cocks, from which proceeds the pipe which supplies the buckets with steam by stopcocks branching off to each. The buckets, in this case, are composed entirely of cast metal, made to hold a determinate quantity, as a bushel or two bushels, and slide with facility off their stand when ready to be emptied and refilled. Barrels, or other capacious vessels, may likewise be attached, to which additional pipes convey the steam; warm water may constantly be had from the boiler, and the superfluous steam may be usefully applied for heating, and other purposes of domestic economy.

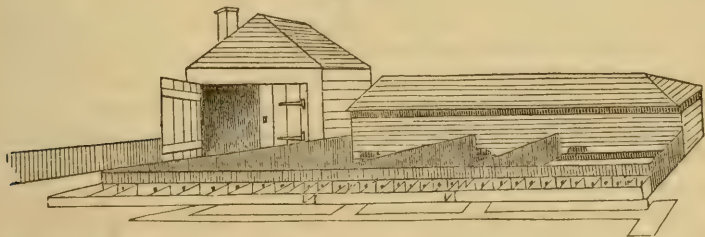
X. PIGGERIES.

Site, &c. — The piggery is usually raised as a mere shed attached to the wall of some farm building, and as near as possible to the kitchen and dairy, — which are too often connected together, — the sole reason of which position being the convenience of supplying it readily with wash. A certain degree of nearness is indeed advisable, for the saving of trouble; and in some farm-houses there is a door or window in the back kitchen communicating with the hog-sty, through which the refuse vegetables and wash can be thrown to the animals without encroaching on time; but the air of a dairy should be ever preserved quite uncontaminated from any foulness of scent. Those on a large scale should, therefore, be so constructed as to divide the range of sties from the dairy-yard by a wall sufficiently high to preclude all communication of unpleasant odor; yet having a cistern, with a trough, or pipes, passed through the wall, so as only to have to cross the court and place the fluid in the reservoir.

Plan of Construction. — Upon whatever scale the piggery is to be erected, it should be raised upon a little declination, so as to allow of the drainage of the urine, to keep the animals dry, and divided into sties of between six and seven feet in width, and fourteen or fifteen feet long; the back part of which should be covered with a low roof, and sufficiently large to allow a fattening hog to lie down conveniently. These sties are sometimes left open in front; but although ventilation should be attended to, yet, in cold weather, they should be boarded nearly to the top, allowing only of a door to enter, and a couple of inches open space at the bottom to carry off the urine. The boards, if placed in a groove of the frame-work, can be removed at pleasure, either to clean the sty or to render it cool. The uncovered part, which is used as a court for the animal to feed in, should be boarded in front by a low paling so as to admit the sun and air, and the trough for the victuals

placed in one corner ; but, as he is very apt to put his feet into the trough, thus soiling and wasting his food, hinged shutters, which give way to the pig's snout and close on his withdrawing his head, are by some persons fixed before the troughs, in order to prevent him. Bars are also occasionally nailed at stated distances across the top of the trough, so as to confine each pig separately to his food, without being able to drive away his fellows. A better mode, however, is to place the trough outside the front paling of the pen, with a hole in it only just large enough to admit of his head ; by which means waste will be avoided, and the trough can be filled and cleaned without entering the court. The sties for breeding-sows, and those used for store-pigs, may be somewhat wider, and the trough should, of course, have a sufficient number of apertures for the little pigs' heads, together with a separate trough, having a larger opening, for the sow, as well as high enough to prevent the sucking pigs from getting into it. Where water can be conveniently obtained, it is a good plan to have a small spout directed through the sties, not only for their more easy cleansing, but to afford the opportunity of always allowing the animals to drink. The building, when not circular, may thus be extended to any length ; and if connected at one end with a boiling-house, and at the other with a cess-pool, into which the drains are emptied, the elevation of the whole will wear the appearance indicated in the following cut.

Fig. 317.



Pigs in Separate Sties, for Fattening. — If many pigs be reared, it is always advisable to keep those of different ages from each other, — and even those of the same brood are not of the same strength ; they should, therefore, be placed in separate sties, not containing more than three or four in each, and those of as nearly as possible equal disposition. In the fattening of hogs, however, many breeders feed them singly in sties which only allow them to lie down, without being admitted to the court ; and some breeders do not allow them room even to turn. Some of these sties are built in the form of a cage of planks, one side of which is made to move

with pegs, so as to fit them exactly, and to be enlarged with their growth ; they are either placed upon wheels for the convenience of moving them, or upon feet a few inches from the ground, with a gently sloping floor to carry off the filth from the back door, and having holes at the bottom for the water to drain from, while they feed through a hole in front. The more general plan, however, is to build the sties in divisions, each to contain a pig, and to fit him as near as may be ; on one side is a range of small troughs, and on the other a row of sliders, which shut in the pigs. No litter of any kind is permitted, as the stalls are placed upon an inclined plane and swept out every day, and the chewing of their litter is thought to be injurious to their thriving. They are found to fatten more speedily, and consequently upon less food, in those sties, than in the common ones, in which they can turn about. This is attributed to their quietude ; and it is said that hogs half fat, — weighing seventy pounds, — when put into one of these cages, may be brought to double their weight within four weeks.

XI. POULTRY-HOUSES.

General Principles and Requisites. — It is well known that too much cold renders fowls torpid, retards and diminishes their laying ; that too much heat enfeebles them ; that the want of good water brings on many disorders ; that too much moisture induces rheumatic swellings ; and that an infected atmosphere renders them sickly and less prolific, injures their flesh, and makes them difficult to rear. From these circumstances may be deduced the principles upon which all poultry-yards should be regulated. The minor details, however, differ considerably in different countries ; and particularly the French and English breeders are quite opposed to each other on several points. In presenting, therefore, the different views and modes of two people so skilful in rearing the various fowls as the French and English, we shall elicit all the most valuable information, with regard to the subject, which will be instructive to the American farmer.

According to the French, in order to unite all the advantages desirable in a poultry-yard, it should be neither too cold during winter nor too hot during summer ; and, if possible, it should be rendered so attractive to the hens as to prevent their laying in any by-place away from it. The extent of the place should be proportional to the number of fowls kept ; but it will be better too small than too large, particularly in winter, for the mutual imparting of animal heat. There is no fear of engendering infectious diseases by too much crowding ; and it is found, in fact, that when fowls are crowded into a small space, their desire for laying continues, even in winter.

Situation, Form, &c. — The best situation for a poultry-house is facing

the east, — neither too far from, nor too near to, the farm-house. The form may be a parallelogram, of twelve feet long by ten broad, and as many in height. The floor must be raised about a foot above the level of the ground, the walls thick, very rough cast, whitewashed without and within, having no chinks, crevices, or cavities, to harbor polecats, weasels, foxes, rats, mice, or even insects; and the roof ought to project considerably, in order to ward off rain, moisture being a most destructive enemy to poultry. The door ought to be small, with an opening at top for the fowls to get in and out, descending therefrom by a ladder, to and from the roosting-place, which should be on a level with it, having one circular window towards the east, and another opposite the west, both of wire-work, with a storm shutter. These windows are chiefly for ventilation, and must be kept always open in summer, and as carefully shut in winter, except on fine days, during sunshine.

Roosting-perches and Nests. — In the interior angles must be placed, upon edges or other supports, at ten or twelve inches distance, roosting-perches, of a square form, for fowls cannot bend their toes so as to grasp firmly a smooth, round perch. The intermediate spaces are appropriated for laying-nests, each covered with two boards, meeting together like a roof, to protect the laying hens from the dung of those on the perches, and to prevent them from being disturbed. These nests are osier baskets, firmly fixed against the walls, well furnished with cut rye straw, often renewed, and disposed so that the fowls may not break the eggs on going in or coming out. A watering place is indispensable, and the water ought to be fresh.

To Render the Poultry-house Healthy. — In order to render the poultry-house healthy, it will not be requisite to fumigate it by burning aromatic plants, incense, or benzoin; fire, air and water, alone are quite sufficient for ventilation and cleanliness. It will be sufficient, therefore, after the fowls have left their roosts, to open the door and the windows of the poultry-house, and, from time to time, to burn a small bundle of straw, for the purpose of causing a circulation of fresh air, and to destroy insects. It will also be necessary to scrub and wash with cold, or rather hot water, and a little vinegar, the nest-basket, roosting-perches, and feeding-troughs.

The surface of the yard ought to be frequently swept, washed, and it may be covered with a bed of gravel, or with straw cut small.

The same house ought to be kept exclusively for the common fowls, other roosting-places being provided for the other sorts; for though these will not be very dissociable with others through the day, they do not like to sleep under the same roof with species different from themselves. In particular, they will not suffer capons, even of their own family, to occupy the same

roosting-perch with themselves. The hens not only show them indifference, but decided aversion.

Conveniences for Hatching. — It is important to have in poultry-houses several small, warm hatching and nursing wards, for hatching the eggs, and sheltering the newly-hatched chickens. In the ward appropriated to the latter, there ought to be separate cages or coops, where each mother remains eight days with her family, after which she is removed into an enclosure to finish the rearing of them, till they can without danger be trusted by themselves.

Appurtenances. — The accessories of the French poultry-house are — a small trench filled with dry sand and ashes, in which the fowls may roll, to free themselves from vermin ; another small trench, containing horse-dung, to be frequently renewed, and in which they amuse themselves, particularly in winter, by scratching for corn and worms ; two squares of turf, on which they may pasture and divert themselves ; a thick, bushy hedge, or, what are better, trees, to furnish shelter from the heat of the sun, — the best sorts of trees being the mulberry and the cherry, as they are very fond of the fruit ; a shed or coping, under which they may take shelter from rain ; stone or wooden cisterns or troughs, or vessels of some sort, with pure water, in order to prevent them seeking by chance what is bad or corrupted.

Air and Space essential. — It has been stated that the French poultry-breeders think it advisable to keep their fowls confined in as small a space as practicable, in order that the warmth may induce them to lay ; in England, on the contrary, a free circulation of air, and abundant space to take exercise in, are reckoned absolutely essential for poultry. Both modes are, to a certain extent, right ; for warmth, and a close, warm roosting-place, will certainly produce most eggs, while air and exercise are necessary to rear fowls of a superior description for the table.

Accommodations for Keeping Poultry on a Large Scale. — Where poultry are kept on a large scale, an enclosure, varying from half an acre to an acre in extent, is set apart for their use, enclosed either by a wall or by a fence of paling, but not by a hedge, as the fowls will get through the latter kind of fence, and will, besides, be very troublesome in laying their eggs in the hedge. The enclosure should be well drained ; and if it has a stream of water running through it, or a pond in the middle, or at one end, it will be best. If it has not these conveniences, it should have a pump, with troughs for the fowls to drink from, and these troughs should be cleaned every day. Part of the yard should be flagged, for feeding the fowls on ; part covered with sand or fine gravel, for them to wallow in ; part laid with turf, that the fowls may find insects and earthworms, and eat grass when they feel inclined ; and part covered with bricklayer's dust, rubbish, dry mortar, and

broken oyster-shells, or other similar materials, rammed down, so that the fowls may amuse themselves with pecking and scratching the ground, without being able to take very much of the limy matters from it at once. Where convenient, the feeding and wallowing places should be roofed over; but the rest of the ground should be exposed to the open air. It must be observed, that, when fowls are kept in small, confined places, they should always be supplied with some kind of limy matter; as, unless they are, the hens will first lay eggs without shells, and after a time will cease to produce any eggs at all. In towns, it is, therefore, customary, with the keepers of poultry for profit, to mix broken egg-shells with their food, and to give them brick partly covered with mortar, from some old building, to peck at.

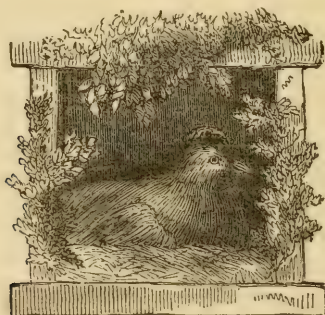
Plan of Construction, and General Management. — The poultry-house may be built of either brick or lath and plaster, or, as in some places, the walls may be of plain boards, — but these generally make the houses too cold. An economical poultry-house may be made of wooden posts and rails, with the spaces between stuffed with fagots; but brick walls are generally preferred to all others, where the expense is not an object. The roof should always be close and secure; and the floor may be of wood, or laid with bricks or flag-stones, or it may be covered with a mixture of lime and clay, rammed hard. Whatever the material be, the floor of a poultry-house should always be a little higher than the level of the yard, to afford facilities for keeping it clean. The floor should be swept every day, and washed once a week, and the walls of the house should be whitewashed inside every spring, and every crevice carefully stopped. The doors are made of wood, and should be strong, and be furnished with a lock, to prevent any danger of the poultry being stolen at night; and there is generally a square hole cut in the door, either at the top or bottom, for the poultry to go to roost. A hole at the top of the door is preferable, as it is inaccessible to vermin; and there should be a ladder on the outside, for the fowls to ascend. This ladder is composed only of a slanting board, with strips of wood nailed across; and, when the hole in the door is at the bottom, a similar ladder is placed inside the house.

All fowls like to roost high, and they should, therefore, have some rails fixed for them near the roof, so arranged that the fowls on the lower rails may not be exposed to the droppings from those above. The rails are frequently only branches, or the trunks of young trees; but if made of timbers, they should be nearly square, with only the corners rounded off; and there may be boxes or baskets against the walls for the fowls to lay in. The best kind of nests are said to be those made of wood, baskets being calculated to let in the cold air.

It is well known that fowls, when left to choose a nest for themselves,

generally fix upon a hedge, where the hen buries herself from observation under the branches of the hedge plants, and among the grass. This peculiarity is taken advantage of by some poulterers, and the laying nests are composed of heath or heather, and branches of hawthorn are trained over and around them. The following figure represents one of these pleasant and comfortable nests, with the hen sitting.

Fig. 318.



XII.—ARRANGEMENT OF THE FARMERY.

Situation. — The several buildings of the farm have now been noticed, and we now come to consider the manner in which they are to be arranged in the farmery. As a whole, it may be considered with reference to its situation on the farm; its extent and character relatively to the size of the farm, and to the kind of culture pursued or crops raised; and its position relatively to that of the farm-house.

For the economy of labor, the buildings of the farm should be situated as near as possible to the centre of the cultivated grounds; for most of the produce being, in the first place, conveyed to the farm buildings, and the manure carried from them to the fields, it is important that the parts of the farm should not be so distant from the farmery, that time shall be wasted by the men and working cattle in traveling. A central situation reduces the labor of carting home produce and carting out manure to the smallest practicable.

But although a central situation of the farm buildings is as much as possible to be aimed at, it is often necessary or expedient to sacrifice this convenience, in order to secure others. A primary object, for instance, is the obtaining of a sufficient command of water for domestic purposes, and the use of the live stock; but this cannot be obtained in every situation, and

convenience of position, therefore, in the buildings, must often be sacrificed, in order to obtain the necessary supplies of water. Sometimes water can be procured in sufficient quantity by sinking wells; but it is always better that it be obtained by a constant flow or current, that the stock of the farm may be supplied at all times without the labor of pumping.

Kind of Buildings. — The size of the farmery, and the kind of buildings which compose it, must necessarily be regulated by the size of the farm, and the kind of culture pursued on it. It is to be observed, however, that although on the smaller class of farms the same accommodation is not required as on those of the larger kind, yet the buildings cannot be reduced in proportion to the diminished size of the farm. Small farms, accordingly, always require a greater comparative extent of accommodation than large. On farms chiefly appropriated to the rearing of stock, comparatively few buildings are required; and these being chiefly sheds for shelter to the young cattle, and low sheds with yards for penning sheep when required. On a farm situated near a large town, the buildings must always be suited to this peculiarity of situation. Here the rearing and feeding of live stock may not be carried on at all, and only the raising of vegetable produce for sale be attended to. The buildings required on such a farm need be few and simple. No feeding and shelter sheds are required, and there is no need for that extension of the range of buildings which is necessary on a rearing and breeding farm.

Disposition of the Different Buildings. — The most convenient disposition of the out-houses of a farm, suited to a mixed system of tillage and the rearing and feeding of live stock, is in the form of a long rectangle, or a square, as the case may be, open at one side, — generally at the south, — so as to admit the air to the cattle in the yards, and allow sufficient sunshine to them in winter. Sufficient space is to be appropriated to the several buildings and yards of the farmery; for a few square yards more, occupied by the buildings, are of little value, compared with the inconvenience which results from having them placed too closely together.

The farm-house itself sometimes forms part of the rectangle formed by the farmery; but it is better, in most cases, that it should be detached. It should be placed on the south or open side of the farm-yard, and some of the windows in the rear of the house should be so arranged that a full view of the proceedings in the yard may be obtained from them.

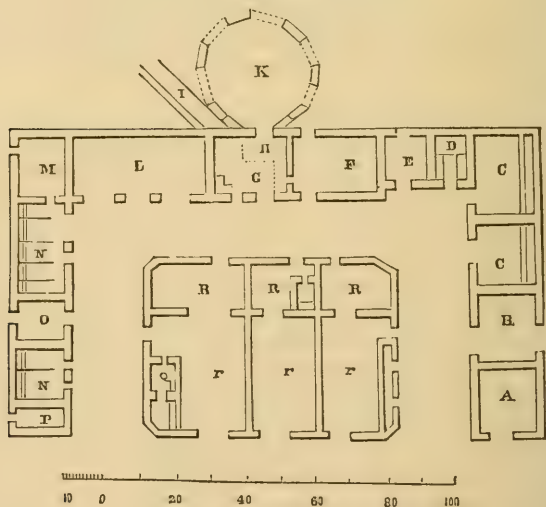
In giving designs of the arrangement of the several parts of the farmery, little more can be done than to present useful examples. Although a certain similarity must exist in the form and arrangement in the parts of all such buildings, yet these, it has been seen, must be modified according to the circumstances of the farm itself, the nature of the soil, the situation with

regard to markets, and many other particulars. No rule that can be given is of general application ; and the judgment of the architect or builder must be exercised in adapting the size, form, and arrangement of the buildings, to the nature of the farm and the wants of the occupier.

In the designs which follow, uniformity has been studied wherever it seemed to be practical, without interfering with convenience of arrangement ; but when these qualities could not be combined, the preference has been given to the latter ; and nothing has been proposed but what has been found, from experience, to be useful and practicable. It may be remarked, however, that it is quite impossible, especially in the larger class of farm buildings, to get the different apartments arranged so conveniently as could be wished, consistent with any degree of regularity. The number of designs might be multiplied to any extent, but this is not at all necessary.

Plan of Buildings for a Farm of One Hundred and Fifty Acres. — The following is a ground-plan design of a farmery for a farm of one hundred and fifty acres arable land. It contains a potato-house, A ; house for storing a

Fig. 319.

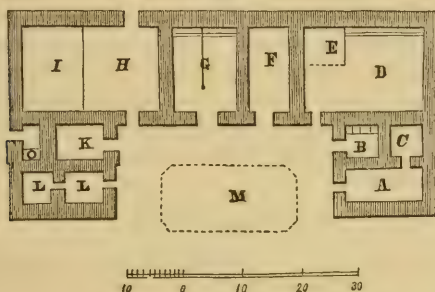


supply of turnips or grass, B ; two cow-houses, C, C ; calf-house, D ; house for mare and foal, E ; straw-barn, F ; dressing-barn, G ; and machinery, H ; gang-way, or inclined plane to the corn-loft, I ; horse-course for the threshing-

machine, K; cart-shed, L; hay-house, M; stables, N, N; spare-house, O; poultry-house, P; piggery, Q; and shelter-sheds, R, R, R; with yards, r, r, r. This plan will afford all the accommodation that could be wished for on a farm of the size for which it is intended

Plan of Buildings for a Small Farm.—The ground plan of the design of a farmery for a small farm is shown in the annexed figure. In it are seen a court for calves, A; poultry-house, B, open to the cow-house to partake

Fig. 320.



of its heat; calf-house, C; cow-house, D; calf-crib, E; cart-shed, F; stable, G; barn, H, part of which, I, is to be lofted over; potato-house, K; piggery, L L, and dung-pit, M.

The Stack-yard.—A situation for the stack-yard should be chosen adjoining the barn, and on the most elevated and exposed side of the farmery. Its size is regulated by that of the arable part of the farm, and also by the size of the barn; as the stacks are not to be made larger than what could be contained at one time by the corn-bay, or end for unthreshed corn; and, consequently, a small barn will require a larger stack-yard than a large one. The farm, in this case, as in almost every other yard or building of the farmery, ought to be rectangular, and as near as may be convenient to that of a square. The stacks are to be placed in parallel rows, with a sufficient space between them for a cart to pass along, either to unload when building the stack, or load when taking the corn to the barn. The stacks are to be placed on stands, to keep dry and free from vermin.

Drainage of a Farmery.—The system of drainage in a farmery is a matter of importance, and it ought to be determined on before any part of the buildings is commenced. There are three distinct systems of drainage which must necessarily exist in every well-arranged farmery. First, it seldom happens that the site for a farmery is so entirely dry as not to require

some underground drains around and through it, for carrying off the water, that either sinks into the soil from the surface and is retained there, or is found latent in the subsoil, or from some other cause. Second, the water from the roofs of the buildings should be all collected by gutters at the eaves, and, if not wanted for a well or tank, it should be conducted directly to the underground drains, through air-traps. Third, a liquid manure tank is essential for retaining those parts of the manure which would otherwise flow out of the yards and be lost; and with this the drains from the stables, cattle-sheds, and yards, are to communicate. These drains must be neither large nor deep; and they may, in general, be formed of brick or stone, with a trap near the opening of each, to prevent the possibility of a current of air passing through them, and the offensive effluvia thereby occasioned. The manure tank may be of very simple construction, the walls being built of stone or brick, — or a large cask may be used. It should be covered at the top, and in the covering there is to be a hole through which the end of a pump may be inserted.

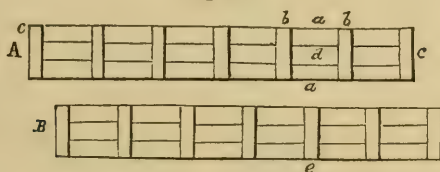
XIII. GREEN-HOUSES.

May be Easily Constructed. — Very handsome structures may be formed by adopting the old mode of building. A house with the simple sloping roof of wood-work may be made both light and airy, if not graceful, provided the moldings of the sashes are made very thin, and the slope of the sashes laid at an angle of not less than 35° . Such a slope is, indeed, almost indispensable, as, if the angle be less, the laps of the glasses are apt to retain water, and cause a drip during rain.

Materials and Mode of Building. — It is astonishing at how trifling a comparative expense a green-house or good glazed pit may be constructed, provided there be a tact for works of masonry and carpentry on the part of the farmer, or gardener, or florist, who wishes such a structure. A green-house, whatever may be its materials and structure, — whether it be curvilinear, and of metal or of wood, with a lean-to roof, or glazed on three of its sides, so as to command a north, south, and eastern exposure, — ought to be at least fifteen feet long, ten or twelve feet high at the back or in the centre, and its breadth not less. It should have a brick wall around it, of nine inches in thickness, the height of which can only be determined by the situation and form of the house; but it is recommended that the cellular mode of laying the bricks be adopted, for a great saving of materials is thereby not only insured, but a plate of air is interposed between two brick surfaces, which tends to preserve uniformity of temperature, and some degree of warmth, within the house. The bricks are laid on edge, two and two, forming the front and back of the wall, with a third one, also on edge,

crossing the end of each pair. One course being thus finished, the course above it is made to break joint with the one below, by laying each pair of bricks so as their centres may rest upon the centres of the cross brick on edge of the course below it. Bond is thus secured, and a space formed between the pairs equal to the difference of the sum of the two bricks on edge and the length of the one that crosses the ends of the two. Supposing the length of a brick to be nine inches, and its thickness three inches, there will be three inches of space left between the bricks. The alternate ranges of the brick-work thus constructed will render the wall cellular, and strength and lightness will be secured. Fig. 321 is a sketch of a portion of two courses of a cellular wall, by which, if the one be supposed to rest upon the other, it will be apparent that each joint alternates with the one below it, and that the cells range throughout in a sidelong oblique direction.

Fig. 321.



In the upper part of the sketch (A), *a, a*, are two bricks set on edge, forming the back and front of the wall *c, c*; *b, b*, are the two bricks also on edge, set across the wall at the ends of *a, a*; *d* is the space between the bricks, three inches in width. The part represented by B is of exactly the same construction as A; and if it were placed on *c, c*, so as the cross-edge brick, *e*, were placed in the middle between the two cross-edge bricks, *b, b*, then the interior of the wall would be of a cellular structure, all the spaces of which would be connected together in a regularly zigzag oblique direction to one another.

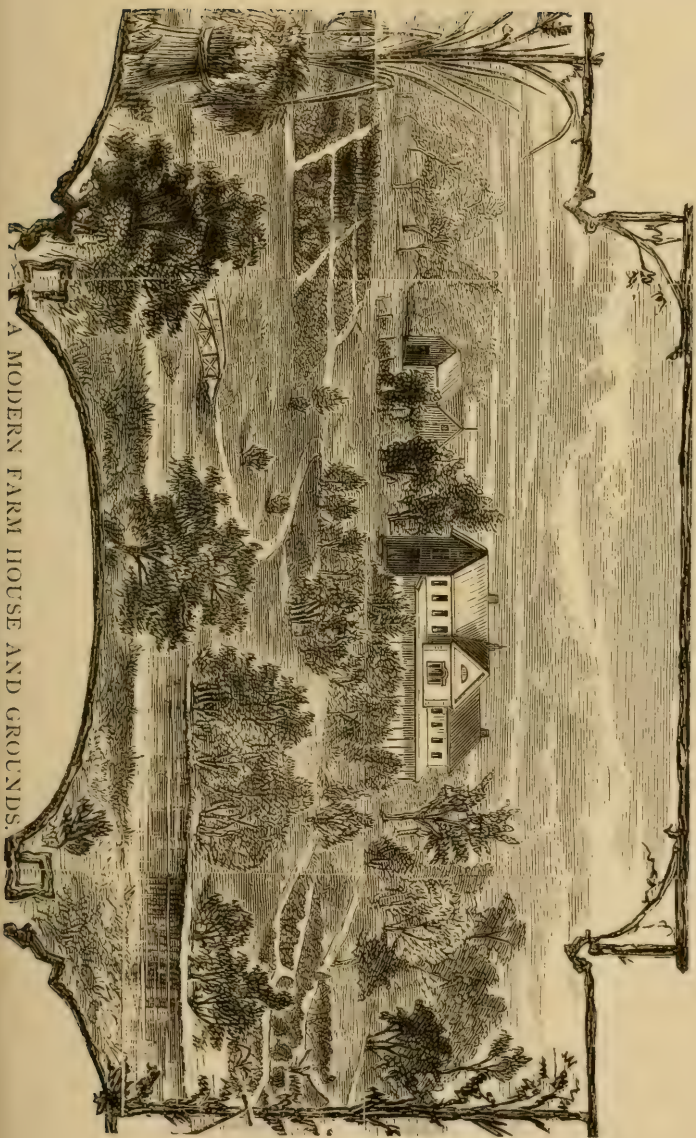
Arrangement of the Lights. — The upright lights above the front walls ought to swing on their centres, and not be made to slide horizontally, by which much rain may be kept out, and the great inconvenience arising from the swelling of the wood in the sash-grooves entirely obviated. A stage, or set of shelves, is generally required, ranging obliquely upwards, from about eighteen inches above the floor towards the back wall, in a direction nearly parallel to the slope of the glass roof. Another shelf, eighteen inches wide, made of bars or strips of wood, may be placed immediately under the swing-lights, against the front wall, for bulbous-rooted plants, heaths, &c., the grating formed by the bars securing the roots from the

bad consequences attending an excess of moisture ; since whatever quality of water may run through the pots will fall through the spaces between the bars, and escape. The walk, in this construction, will pass between this front-sparred shelf and the lower shelf of the stage ; it may also proceed along the *back* wall, in which case the platform of shelves should be curtailed in breadth, and a shelf or two fixed upon the back wall itself, for succulent plants. In houses with double glass roofs, the stage ought to be in the centre, ranging in two slopes, corresponding to those of the lights.

Flues for Heating. — The *flues*, or hot water pipes, must be so situated as to distribute the heat equally. The circulation of hot water is most likely to afford this equal distribution, because the temperature of a stream of water flowing *from* a boiler, and returning *to* it, in regular but slow progression, must be subject to comparatively little variation. Hot water also produces a sweet and innoxious heat. Whenever, then, circumstances authorize this mode of creating an artificial climate, it ought unquestionably to be adopted ; but it requires some one who is somewhat acquainted with this species of work, and with the power which radiating surfaces possess of regulating the temperature of a given number of cubic feet of air.

A *brick flue*, when placed above the floor, being rather an unsightly object, it may be advantageously placed under, or rather on a level with, the floor. A flue, to command a pretty regular temperature, ought to enter at one end of the house, not many inches within the front wall, proceed along its whole extent, then take a turn and be brought back about the centre of the floor, and finally be carried into a chimney above the back wall at the same *end* of the house, though at an opposite corner, in which the fire is situated. The flues are to be so built that air may circulate around them ; hence they must be placed in a channel dug in the ground, and wholly free from contact with the ground. Exits for the heated air must be provided for, either by gratings or by spaces left in the floor. The temperature of the air in the green-house will thus be regulated from the surface of the floor itself to the roof, without the inconveniences of an incommodious mass of projecting brickwork.

A good flue has been calculated to heat between four and five thousand cubic feet of air to a temperature sufficient for the safety of green-house plants. Now, supposing the internal dimensions of a house to be as follows : height at the back, 12 feet, sloping to 6 feet at the front, the medium being 9 feet ; breadth 12 feet, and length 24 feet ; $24 \times 12 \times 9$ will produce the sum of 2592 feet, the volume of air to be warmed. If, then, the calculation of 5000 feet be correct, there can be no difficulty in supporting a sufficient degree of heat in a house of little more than half those dimensions, by a flue of moderate capacity. This may be attained by building



A MODERN FARM HOUSE AND GROUNDS.

the outside and inside of the first course along the front wall, with four *bricks laid flat-wise* above each other upon the foundation or base course. These four bricks will form the depth and the side of the flue, which, with the mortar-joints, will be twelve inches in the clear; and by setting the other side of the flue seven inches apart from the first, there will be a channel of eighty-four square inches in the clear, which will be found amply sufficient for a flue. The return flue ought to be built of *bricks on edge*, but not wider than the first, and both should be covered with flat stones. To secure the full effect of the flue, the fireplace should be sunk one foot, or more, below the entrance or mouth of the flue, so as to admit of a rise from the fire to the flue. This rise should form the neck of the flue, and be brought to assume somewhat the figure of a hopper. Thus, if the fireplace be eighteen inches long, twelve inches wide, and as many deep, the neck ought to be so contracted as that, at its entrance into the flue, it is not above half the breadth of the fireplace, nor more than eight inches in depth. The flame of the fuel ought to deliver itself clearly into the flue; and to do this, the neck should not be much more than a foot in length, — the chief causes of a bad draught and a smoky chimney arising from the ill-calculated dimensions or shape of the neck. If the neck be short, and regularly contracted, till it be about half the size of the flue into which it enters, rarefaction of the air will be secured; and if, with these precautions, a moderate rise be provided, the rush of air will be great, which will render the draught secure in almost every possible state of the atmosphere.

The flue being built, its joints rendered air-tight, a space, as was before observed, must be left on each side of it, with openings in the pavement for the free egress of the heated air. The base of the flue ought not to rest on the ground, but upon bricks laid apart, so as to form openings through which the air warmed by the bottom of the flue may pass into the channels left on both sides. A flue thus constructed, and carefully built, will be so efficient that very little fuel need be consumed; every particle of it will have its effect, and the house will be pleasantly heated, without trouble, loss of time, or vexatious expenditure.

XIV. FENCES AND GATES.

FENCES.

Different Kinds. — The fences of the farm may consist either of stone wall, or of line fence, or of a combination of the line fence and stone wall, or of an open ditch, a mound, or a rail.

Building Stone Wall. — The stone wall may either be formed of stones, quilt without cement, or it may be built with mortar, like common masonry; but the last of these methods is rarely practised with the common fences of a

farm The cementing of the stones with mortar adds, indeed, to the durability of the wall, but then the expense is too great in common cases. The wall, therefore, for the ordinary purposes of the farm, may generally be built of stones alone, though sometimes with a little mortar merely for cementing the capping, and occasionally for pinning or closing the interstices of the outside.

Materials. — The materials for building the dry stone wall, as this kind of wall is termed, may be of any stones of sufficient durability. Loose stones taken from the surface, termed land-stones, answer completely, if they be of proper size, and not too much rounded; but in the latter case they present too smooth a surface, and cannot be kept in their places without mortar.

Implements. — The implements to be used in building stone wall are, a mason's hammer, a spade or shovel for clearing the ground for a foundation, a pick or mattock, and a frame of two upright posts fixed together, so as to correspond with a vertical section of a portion of the wall. The line of the intended fence being fixed upon and marked on the ground, the stones for building should be brought forward, and laid down on both sides, if possible, of the line of fence, but, if not, on one side. Pins being fixed in the centre of the space to be occupied by the wall, the workman proceeds thus: — He carries his wooden frame to some distance along the line to be built upon; he sets it perpendicular, which he is enabled to do by means of a plumb-line attached to it, and he fixes it in this position in a simple manner, as seen in the figure below. He then fixes another similar frame at the place where the wall is to commence; he stretches two cords between these two frames, on the outside, and as these cords correspond with the outside of the wall at a given height, he has a guide for building it of the required dimensions. After having built one portion, he uses only one frame, — the wall itself serving afterwards the part of a frame, — for

Fig. 322.



the cords being fixed to both sides of the wall, and then attached to the frame which is placed in advance, the workman has, as before, a guide by which he proceeds in building.

Rules to be observed. — The foundation of the wall should be laid on firm ground; and wherever there is not this to build upon, a solid foundation

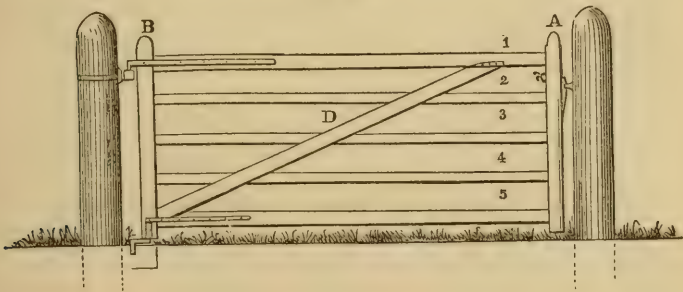
should be made by the spade. In building, the largest and flattest stones should be used for the foundation; and it is very desirable, if the materials used will allow, to place stones at intervals, of sufficient size to lie across the breadth of the wall, so as to bind the wall together, and render it more secure.

Advantages of the Stone Wall. — The advantages of the stone wall, as compared with the line fence, or hedge, are, that it becomes useful as soon as made; that it can be formed in any situations, irrespective of soil and climate; that it requires no nursing, cleaning, and pruning; that it is not injured or destroyed by the trespasses of animals, and that it occupies little room

GATES.

Form and Method of Construction. — A necessary part of any kind of fence is the gate. The properties of a good gate are that it shall combine lightness with necessary strength, so that an equal quantity of materials shall produce the strongest gate. The kind of gate which best combines these conditions is one which consists of horizontal bars, placed at such a distance from one another as to prevent the passage of animals, and so connected as to be firmly bound together. The number of horizontal rails should be five, although four may suffice, in low gates. They are mortised into two upright bars, which form the ends of the gate. A diagonal bar proceeds from the hinder and lower corner of the gate to the upper bar. It abuts upon the hinder upright, and on the upper horizontal bar, and is nailed to the intervening ones. It may form an angle of about forty-five degrees

Fig. 323.



with the hinder upright and lower bar, so that it may abut upon the upper bar, at some distance from the fore-part of the gate. It forms, in this position, a strut, — in the language of carpentry, — which is better than when it forms a tie, according to the common practice; — that is, when it extends

from the upper hinder corner to the lower bar of the gate. These parts form the framing of the gate. It is usual, however, to nail two upright braces to the gate. These are unnecessary for strength, and add to the quantity of materials, and the number of joinings. The length of the gate may be nine feet, the height of the upper bar three feet nine inches, and the lower bar may be six inches from the ground. Fig. 323 describes a gate constructed on these principles : — A and B are the upright bars ; 1, 2, 3, 4, 5, the horizontal bars, mortised into the former ; D, the diagonal strut, abutting on the upright bar, B, and on the upper horizontal bar, 1, and nailed to the other bars, 2, 3, 4, 5.

Hanging. — The gate may be hung upon two hinges, or on one hinge, — the hilt resting on a stone socket, placed in the ground, as shown in Fig. 323. This latter construction is somewhat the best for the ordinary gates of the farm ; for one of the most common defects of gates is the tendency to sink down at the fore-part, and trail on the ground. Now, a gate, when we consider its tendency to sink at the fore-part, may be regarded as a bended lever, of which the fulcrum is the lower hinge, the power which prevents its sinking the upper hinge, and the weight the centre of gravity of the gate. By increasing the distance between the fulcrum and the upper hinge, we increase the power of the latter to support the gate ; and this condition is fulfilled by placing the heel of the gate on the level of the ground. This tendency to trail is also lessened by making the gate lighter before, which is effected by giving the several bars a taper from the hinder to the anterior part.

The Hinges. — The hinge of the gate is best formed by causing the upper part — which is fixed to the upright bar of the gate — to work in a socket, which is fixed to the gate-post. The advantage of making the upper hinge work in a socket is, that while space is given to it to turn, it is firmly supported in its place, and that the means are afforded of causing it to move smoothly, by pouring a little oil into the socket.

The Latch. — The latch of the gate may be of various forms. The simplest is a little chain, fixed to the front upright bar, which is fastened to a hook in the gate-post.

Gate-posts. — The gate-posts for the common gates of a farm are better formed of wood than a pillar of masonry, — the latter being subject to be loosened by carriages striking against it. The posts, if of wood, should be well sunk in the ground ; and, as they are apt to decay at the surface of the ground, the sunk portion, and a little above it, should be charred. The bands of the hinges and latches should pass entirely through the posts, and be fixed on the opposite side by screw-nuts. The most durable kind of gate-

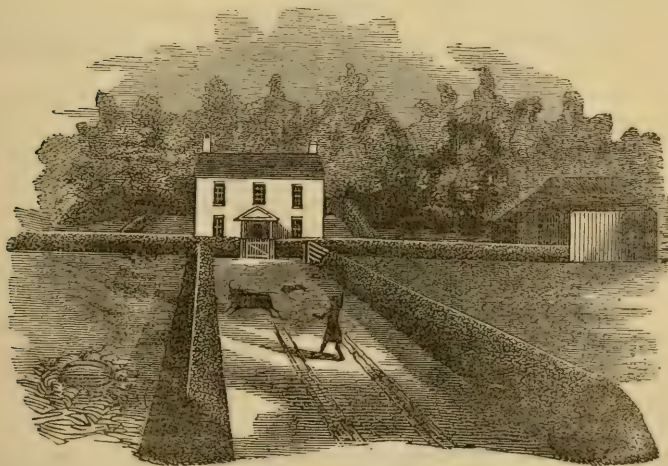
post, however, is one of solid stone, which may be advantageously adopted where the material can be easily obtained.

Self-shutting Gate. — It is, in many cases, deemed convenient to have a gate which shall shut of itself, when opened. This may be effected by simple means. The upper hinge may be of the kind before described; but the gate below must, in place of the hinge, have two points of support, so that it shall only be in equilibrio when it rests upon these two points.

XV. HEDGES.

General Remarks. — For beauty, economy, and the protection of land from intruders of all kinds, whether biped or quadruped, no kind of enclosure can equal that furnished by a good hedge. These living walls of verdure present a most striking effect, especially where the ground is somewhat rolling, and relieve the monotony of cultivated fields, where there are no forests to lend a coloring to the view. Their first cost is probably a little more than that of a fence of the ordinary kind; but when once completed, which is usually in about four or five years, the expense ceases at once and forever, whereas the wooden fence or stone-

Fig. 324.



wall continually require repairs, and occasionally rebuilding. They are absolutely impassable, when properly constructed: nothing in the form

of man, animal, or of the poultry kind, can either get through or go over them; and they form an excellent shelter for cattle during the winter season, while ranging the fields for exercise, or to pick up a few mouthfuls of green food.

Varieties of Hedge Plants.—The principal, and by some asserted to be the only plant fit for hedges in the United States, is the osage-orange (*Machura-auriantica*; illustrated in Fig. 324 as it appears on the farm when nicely trimmed), which grows wild in Arkansas and Louisiana. It is very full of branches, each of which is armed with numerous sharp thorns. The trees are male and female, and the latter bears a round, rough and greenish-colored fruit, somewhat like an orange, containing about two hundred seeds. The wood is very tough and durable, and the trees are very readily raised from seed, which will never fail to vegetate in two or three weeks after planting. In the first season the seedlings will grow to the height of two or three feet, when they may be set out in the hedge rows, where the sets are usually placed from twelve to fifteen inches apart. The great merit of this plant consists in the manner in which it spreads its branches, and interlocks them, and in the bristling array of spines with which they are armed. It never becomes unmanageable on account of its size, and in four or five years will make a good fence from the seed.

The *Honey Locust* (*Gleditschia triacanthos*), (Fig. 325), is naturally a large tree, beautiful in foliage, but armed with terrific thorns, which are

Fig. 325.



sometimes several inches long, of a reddish color, and, at some distance from the base, armed with two secondary thorns, about half the size of the first. The leaves are pinnated, and composed of small, oval, serrate, sessile leaflets, of a very pretty lightish green color. The flowers are

small, disposed in bunches, and not very conspicuous. Flat, crooked, pendulous pods, from twelve to eighteen inches long, contain the seeds, which are brown, smooth, hard, and enveloped in a very sweet pulpy substance. Its close, impenetrable mass of thorns and spray peculiarly adapts it for hedging.

The *Buffalo Berry* (*Shepardia magnoides*), is a peculiar thorny plant, found on the Rocky Mountains. It grows upright, and is armed with thorns; and the leaves, which are small, have a delicate, silvery appearance. It is male and female, and bears a fruit which, with a very rich taste, combines a fine scarlet color, and has much of the appearance of currants, hanging from the branches in similar bunches. Tarts and preserves have been made from them, and pronounced excellent. It is better adapted to garden than field fences.

The *Buckthorn* (*Rhamnus catharticus*), indigenous to the United States, as also to Europe and Asia, is a hardy prickly shrub, the bark of which is glossy and dark-colored. The leaves are ovate, dentated, with linear stipules, and strong lateral nerves: the flowers, which are yellowish green, give place to a glossy black berry, of the size of a large peppercorn, containing three or four seeds, enveloped in a violet-red pulp. The juice of the unripe berries, boiled with a little alum, makes a deep green dye. This shrub is very easily propagated from the seed, and is much used as a hedge-plant in many of the Northern and Eastern States.

The *Cockspur* (*Crataegus crusgalli*), a native of the Middle States, is a beautiful plant, having long, deep green, and highly-polished leaves, with finely serrated margins. The thorns are very long, slender, and tough; and the fruit, which is of a handsome golden yellow color, hangs on the shrub all winter, giving it a beautiful appearance. It forms an excellent hedge, and makes a gorgeous display during the winter season.

The *Red Cedar* (*Juniperus Virginiana*), is sometimes used for hedges, although it is simply an evergreen, and entirely destitute of prickles. The wood is very odorous, and the leaves, when bruised, diffuse a resinous aromatic odor. The seeds are small, ovate berries, bluish when ripe, and coated with a whitish exudation. The plant grows readily from the seed, may be set out in two years, and will furnish a shelter at the end of three or four years. It will make a compact wall of verdure from the very ground, and bears clipping remarkably well.

The *Cranjero* (*Celtis cinerea*), a very thorny shrub, growing in Western Texas among the chapparal, would make an excellent hedge. Its usual height is from six to ten feet, with numerous very rigid branches,

armed with short but strong spines. The leaves are about an inch long, of an oval shape, and the flowers, which are polygamous, are quite small, and in color greenish-white. It bears orange-yellow, oval berries, the size of peas. As the plant grows in poor and stony soils, it is presumable that it would thrive in almost any situation.

Fig. 326.



The *Cactus Tuna* (*Fijo de Inferno*), (Fig. 326), and the *Cactus Opuntia* (Fig. 327), are much used for hedges in Spain, where they are said

Fig. 327.



to make a fence in two years which lasts for forty, and which, under proper management, might be made perennial. It is objected that they occupy considerable space, and that the trimmings will retain life and grow even on dry ground; but these objections do not apply where land is plenty, and lime in abundance, with which to compost the trimmings. These plants make an impassable fence, and one which is easily planted and kept in order.

The *Mesquit* (*Algarobia glandulosa*) often grows into a good-sized tree, but can readily be kept within the proper size for a hedge by trimming. Its foliage, which is very graceful, is not unlike that of the honey-locust, and at the base of each compound leaf a pair of very sharp thorns is usually produced.

The *Zizyphus lycoides* grows abundantly throughout Texas and New Mexico. It is intricately branched; the leaves are oblong and entire; the flowers are small, white, and grow in sessile clusters, giving place to round, black, edible, but rather astringent berries; and the entire plant usually attains a height of six or eight feet.

Emory's Thorn (*Holocantha Emoryi*) is, like most of the Cactaceæ, a thorny, leafless plant, growing in bunches, from five to eight feet high, and bears tufts of very minute greenish-white flowers, which are succeeded by stellate reddish seed-vessels. It consists almost wholly of thorns, which are very rigid, and average from two to four inches in length. It is an ugly plant, but would form an impenetrable hedge.

Planting the Hedge. — If the sod is new, break it up in the fall, and in spring plough it, throwing the furrows outward, so as to leave a broad furrow in the middle, in the line of the intended hedge. If the ground is rough, it must be very thoroughly harrowed at planting time, and the earth, thrown into the centre by ploughing from both sides, must be allowed to settle for a few days before planting the hedge, to prevent subsequent exposure of the roots. As it is requisite, in order to have a handsome-looking hedge, to plant the sets in a straight line, the ground should be staked off at regular distances, and a cord run from one stake to another as a guide. When the plants are ready, they may be set in the ground with but little trouble, by inserting a spade to the depth of five or six inches, close to the line, pressing it outward, and dropping a plant into the hole thus made. The spade may then be withdrawn, and inserted a short distance behind its first position, by which the ground is pressed forward against the plant, thus fixing it firmly in position. Some operators use a trowel, made for the purpose, but without any positive advantage. A double row, with the plants alternating, is preferable to a single-row hedge. In no case should they be planted

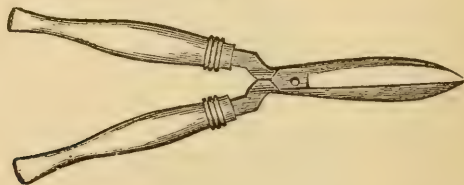
nearer than ten inches asunder in the rows, and the rows should be at least eight inches apart. Many of the hedge-plants will require to be planted at even a greater distance from each other, or they will not thrive.

First Year. — Keep the ground mellow, and clear of weeds. Throw a furrow against the plants on each side, and subsequently plough from them when weeds and grass spring up. Repeat this operation as often as any obnoxious vegetation makes its appearance, and late in the autumn plough two heavy furrows against the hedge on each side, to protect the roots from the frost. Trim frequently during the summer, keeping the shoots down within three or four inches of the ground. They will thicken under this treatment, and will stand the winter better than if allowed to run up to a height of several feet.

Second Year. — Replace all the plants which have died, setting them carefully, so as to insure their successful growth. Cultivate as during the first year. Cut the plants down to the ground in the spring with a scythe, and in June trim all the vertical shoots down to four inches, but allow the horizontal branches to extend as far as they will. A thick growth will follow, and thus will be established a good foundation for the future hedge. Protect the plants from the frost by throwing a furrow against them, and leave them until the spring of the

Third Year. — Trim down the plants to within five inches of the last cut, and cultivate as before. The hedge now being very wide, but little vegetation will grow beneath it, consequently so much labor will not be required in clearing out weeds. Prune again in June, within five inches of the spring cutting, and trim the hedge in a pyramidal form, so as to

Fig. 328.



give it all the benefit of sun, air, and moisture. Trim again in August, leaving six inches more of the new wood, and again in September. Fig. 328 represents a pair of Hedge-Shears.

Fourth Year. — The labor of this and all succeeding years will mainly consist in keeping the hedge properly trimmed. Preserve the pyra-

midal form, as upon that depends the permanence of this living barrier; and encourage the plants to grow vigorously by the application of some well-rotted manure.

Replanting and Mending.—A ragged and uneven hedge should be cut down at once, in the spring, nearly to a level with the ground, all the stunted plants removed, and their places filled with good plants, which must be set with great care. Clip all the hedge, with the exception of the replants, two or three times during each year—thus giving the latter a chance to attain a vigorous growth. Their places may be covered by training strong shoots into them, and confining them there during the growing season.

CHAPTER XII.

HORTICULTURAL SCIENTIFIC OPERATIONS.

THE IMPROVED MODES OF GRAFTING — BUDDING — PRUNING — TRAINING.

I. GRAFTING.

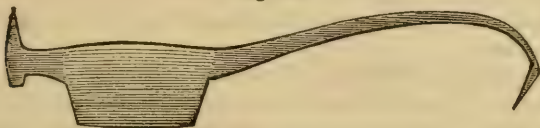
Uses of Grafting. — The uses of grafting, in addition to those of all the other modes of increasing plants by extension, are, 1. The propagation of varieties or species which are not increased freely by any other mode, such as pears and other fruit-trees, &c. 2. The acceleration of the fructification of plants, more especially of trees and shrubs, which are naturally a number of years before they come into flower. For example, a seedling apple, if grafted the second year on the extremities of the branches of a full-grown apple-tree, or even on a stock or young tree of five or six years' growth, will show flowers the third or fourth year; whereas, had it remained on its own roots, it would probably not have come into flower for several years longer. 3. To increase the vigor or the hardiness of delicate species or varieties, by grafting them on robust stocks. 4. To dwarf or diminish the bulk of robust species, — such as grafting the pear on the quince or medlar, the apple on the doucin or paradise stock, the cherry on the perfumed cherry, &c. 5. To increase the fruitfulness or precocity of trees; the effects produced on the growth and produce of a tree by grafting are similar to those which occur when the descent of the sap is impeded by a ligature, or by the destruction of a circle of bark. The disposition in young trees to produce and nourish blossom buds and fruit is increased by this apparent obstruction of the descending sap; and the fruit of such young trees ripens somewhat earlier than upon other young trees of the same age, which grow upon stocks of their own species; but the growth and vigor of the tree, and its power to nourish a succession of heavy crops, are diminished, apparently, by the stagnation in the branches and stock of a portion of that sap which, in a tree growing upon its own stem, or upon a stock of its own species, would descend to nourish and promote the extension of the roots. 6. To preserve varieties from degenerating, which are found to do so when propagated by cuttings or layers. 7. By choosing a stock suitable to the soil, to produce trees in situations where they could not be grown if on their own

roots. 8. To introduce several kinds on one kind. Thus, one apple or pear tree may be made to produce many different kinds. 9. To renew the heads of trees. Thus, if a fruit-tree is cut down to the ground, or headed in to the height of ten or twelve feet, and left to itself, it will develop a great number of latent buds, each of which will be contending for the mastery; and the strength of the tree, and the most favorable part of the season for growth, will be in some degree wasted, before a shoot is singled out to take the lead; but, if a graft is inserted either in the collar or stool, or in the amputated head, it will give an immediate direction to the sap, the latent buds will not be excited, and the whole concentrated vigor of the tree will be exerted in the production of one grand shoot.

Different Kinds of Grafting. — The different kinds of grafting may be classed as, grafting by detached scions or cuttings, which is the most common mode; grafting by attached scions, or, as it is commonly termed, by approach or inarching, in which the scion, when put on the stock, is not at all, or is only partially, separated from the parent plant; and grafting by buds, in which the scion consists of a plate of bark, containing one or more buds. The stock on which the scion is placed is, in every case, a rooted plant, generally standing in its place in the garden or nursery, but sometimes, in the case of grafting by detached scions, taken up and kept under cover, while the operation is being performed. The two first modes of grafting are performed when the sap is rising, in spring; and budding chiefly when it is descending, in July and August. Under particular circumstances, however, and with care, grafting in every form may be performed at any reasonable period of the year.

Utensils and Materials used in Grafting. — These are, the common knife, for heading down stocks; the chisel; the grafting-knife and budding-knife; ligatures of different kinds for tying on the scions, and grafting-clay or grafting-wax for covering them. The following cut represents one of the best grafting-

Fig. 329.



chisels now in use. The ligatures in common use are strands of bast matting, or of other flexible bark; but sometimes coarse worsted thread is used, or occasionally shreds of coarse paper, or cotton cloth, covered with grafting-wax. When bast mat is used, it may be rendered water-proof by passing it first through a solution of white soap, and next through one of alum; by which

a neutral compound is formed, insoluble in water. These prepared shreds, before being put on, are softened, by holding them over a small vessel of burning charcoal, which the grafter carries with him; and when grafting-wax is employed, instead of grafting-clay, it is kept in an earthen pot, also placed over live charcoal, and the composition taken out and laid on with the brush. There are compositions, however, which become soft by the heat of the hand, or by breathing on them.

Grafting-clay is prepared by mixing clay of any kind, or clayey loam, fresh horse or cow dung, free from litter, in the proportion of three parts in bulk of clay to one of dung, and adding a small portion of hay, not, however, cut into too short lengths, its use being analogous to that of hair in plaster. The whole is thoroughly mixed together, and beaten up with water, so as to be of a suitable consistency and ductility for putting on with the hands, and for remaining on, in wet weather and dry weather, without cracking. The beating is performed with a beetle or rammer, on a smooth, hard floor, under cover, turning over the mass, and adding water, and then beating afresh, till it becomes sufficiently softened and ductile. The process of beating must be repeated two or three times a day, for several days; and it should be completed from three weeks to a month before the clay is wanted, care being taken to preserve it in a moist state, by covering it with mats or straw. The grafting-clay used by the French gardeners is composed of equal parts of cow-dung, free from litter, and fresh loam, thoroughly beaten up and incorporated.

Grafting-wax is used by many instead of grafting-clay. There are various recipes for composing it, but they may all be reduced to two kinds. 1. Those which, being melted, are laid on the graft, in a fluid and hot state, with a brush. 2. Those which are previously spread on pieces of coarse cotton, or brown paper, and afterwards wrapped round the grafter in the same manner as strands of matting. The common composition for the first kind is one pound of cow-dung, half a pound of pitch, and half a pound of yellow wax, boiled up together, and heated, when wanted, in a small earthen pot. For the second kind, equal parts of turpentine, bees-wax, and resin, are melted together.

Grafting by Detached Scions. — This is the most common mode, and it is that most generally used for kernel-fruits, and the hardier forest-trees. The time for grafting hardy trees and shrubs by detached scions in England is generally in spring, when the sap is rising; but the vine, if grafted before it is in leaf, suffers from bleeding. In this country, grafting is frequently performed in the winter time on roots or stocks which have been preserved in sheds or cellars; and the scion being put on and tied and clayed over, the grafted stock is kept till the spring, and then taken out and planted. Plants

under glass may be grafted at almost any period ; and herbaceous grafting, when and wherever performed, can, of course, only succeed when the shoots of the scion and stock are in a succulent or herbaceous state. In all the different modes of grafting by detached scions, success is rendered more certain when the sap of the stock is in a more advanced and vigorous state than that of the scion ; for which purpose the scions are generally taken off in autumn, and their vegetation retarded by keeping them in a shady place till spring ; and the stock is cut over a little above the part where the scion is to be put on, a week or two before grafting takes place. The manual precautions necessary to success are — to fit the scion to the stock in such a manner that the union of their inner barks, and consequently of their alburnums (*sap*), may be as close as possible ; to cut the scion in such a manner as that there shall be a bud or joint at its lower extremity, and the stock so that there shall be a bud or joint at its upper extremity ; to maintain the scion and the stock in the proper position for growth, and in close contact, by a bandage of narrow shreds of matting or cloth ; to exclude the air by a covering of clay or grafting-wax, and, in addition, when the graft is close to the surface of the ground, by earthing it up with soil, and when the scion is making its shoot, to tie it to a prop, if necessary ; to remove the clay or grafting-wax, when the scion has made several leaves ; to remove the bandage by degrees, when it appears to be no longer necessary ; and to cut off the heel on the upper part of the stock at the proper time, so as that it may, if possible, be healed over the same season. The modes of grafting detached scions adapted for general use are — splice or whip grafting, cleft grafting, rind grafting, saddle grafting, side grafting, root grafting and herbaceous grafting.

Splice Grafting. — Splice, tongue, or whip grafting, is the mode most commonly adopted in all gardens where the stocks are not much larger in diameter than the scion ; and it has the advantage of being more expeditiously performed than any of the other modes described. The stock is first cut over at the height at which the scion is to be put on, *a* (Fig. 330), and a thin slice of the bark and wood is then cut off with a very sharp knife, so as to leave a perfectly smooth, even surface, *b* ; the scion, which should at least have three buds, and need never have more than five (the top one for a leading shoot, the next two for side shoots, in the case of fruit-trees, and the lower two to aid in uniting the scion to the stock), is next cut, so as to fit the prepared part of the stock as accurately as possible, at least on one side ; then a slit or tongue, as it is technically termed, is made on the scion, and a corresponding one in the stock, *c*. All being prepared, the scion is applied to the stock, inserting the tongue of the one into the slit of the other, *c* ; then the scion is tied on with matting, *d* ; and lastly it is clayed over, *e* ; and

sometimes, in addition, it is earthed up, or covered with moss, to serve as a non-conductor of heat and moisture. In earthing up the graft, the loose

Fig. 330.



surface soil should be used at the grafting season, as being drier and warmer than that which is less under the immediate influence of the sun. When the scion is placed on the stock with the right hand, the ribbon of bast, by which it is tied, is brought round the graft from right to left; but when the scion is put on by the left hand, the bast is brought round from left to right; the object in both cases being to make sure of the exact coincidence of the inner bark of one side of the scion with the inner bark of one side of the stock. The ball of clay which envelops the graft should be about an inch thick on every side, and should extend for nearly an inch below the bottom of the graft, to more than an inch over the top of the stock, compressing and finishing the whole into a kind of oval or egg-shape form, closing it in every part, so as completely to exclude air, light, wet or cold. The ball of clay will not be so apt to drop off, if the matting over which it is placed is rendered a fitting nucleus for solid clay, by previously smearing it over in a comparatively liquid state. This envelope of clay, with the earthing up, preserves the graft in a uniform temperature, and prevents the rising of the sap from being checked by cold days or nights; and, therefore, earthing up ought always to be adopted, in the case of grafts in the open garden, which are difficult to succeed. When the scion and the stock are both of the same thickness, or when they are of kinds which do not unite freely, the tongue is sometimes omitted; but in that case more care is required in tying. In this, and also in other cases, the stock is not shortened down to the graft, but an inch or two, with a bud at its upper extremity, is left to insure the rising of the sap to the scion; and after the latter is firmly established, the part of the stock left is cut off close above the scion. When the stock is not

headed down till the scion is about to be put on, it is essentially necessary to leave it longer than usual, in order to give vent to the rising sap, which might otherwise exude about the scion, and occasion its decay.

Splice Grafting the Peach, Nectarine, Apricot, &c. — In splice grafting the shoots of peaches, nectarines, and apricots, and other tender shoots with large pith, it is found of advantage to have a quarter of an inch of two-years-old wood at the lower extremity of the scion, and to have the stock cut with a dove-tail notch. In the case of the fruit-trees mentioned, the buds of the scion on the back and front are removed, leaving two on each side, and a leader; and when these have grown six or eight inches, their extremities are pinched off with the finger and thumb, by which means each shoot will throw out two others, and thus produce in autumn a finely-shaped tree, with ten branches. Such trees will bear two or three fruits the second year from the graft.

Cleft Grafting. — This requires less care than splice grafting, and is chiefly adopted when the scion is a good deal larger than the stock, and more especially when grafting stocks of considerable height, or heading down old trees. The head of the stock being cut over horizontally with a saw, a cleft is made in it, from two to three inches in length, with a stout knife or chisel, or with the splitting-knife. The cleft being kept open by the knife or chisel, or the pick end of the splitting-knife, one or two scions are inserted, according to the diameter of the stock; the scions being cut into long wedge-shapes, in a double sense, and inserted into the slit prepared for them, when the knife or chisel being withdrawn, the stock closes firmly upon the scions, and holds them fast. The graft is then tied and clayed in the usual manner, and the whole is frequently covered with moss, or some similar substance. When the stock is an inch or more in diameter, three or more scions are frequently put on at equal distances from each other round the circumference, and this is called *crown grafting*. Cleft grafting with one scion is in general not a good mode, because, if the split has been made right through the stock, it is in danger of being injured by the weather before it is covered with wood by the scion. If the cleft is made only on one side of the stock, the evil is mitigated; but there still remains the tendency of the scion in its growth to protrude the wood all on one side. In crown grafting headed-down old trees, the scion is generally chosen of two-years-old wood, and it is sometimes inserted between the inner bark and the alburnum, as in what is called —

Rind Grafting. — In this, great care must be taken to open the bark of the stock, without bruising it, which is done by the spatula end of the grafting-knife. The scion is prepared without a tongue, and inserted so that its wood may be in contact with the sap of the stock. As in this case both

edges of the alburnum of the scion come in close contact with the alburnum of the stock, the chances of success, other circumstances being alike, are increased. In cases of this kind, also, a longitudinal notch is sometimes cut out, instead of a slit, and the scion cut to correspond. Sometimes, also, the scion is prepared with a shoulder, more especially when it consists of two-years-old wood; and this mode is termed *shoulder grafting*.

Cleft Grafting the Vine.—This operation is shown in the annexed cut, in which *a* is a bud on the scion, and *b* one on the stock, both in the most

Fig. 331.



favorable positions for success. The graft is tied and clayed in the usual manner, excepting that only a small hole is left in the clay opposite the eye of the scion, for its development. In grafting the vine in this manner, when the bud *b* on the stock is developed, it is allowed to grow for ten or fourteen days, after which it is cut off, leaving only one bud and one leaf near its base to draw up sap to the scion till it be fairly united to the stock. The time of grafting is when the stock is about to break into leaf, or when they have made shoots with four or five leaves. By this time the sap has begun to flow freely, so that there is no danger of the stock suffering from bleeding; though, if vines are in good health, and their wood thoroughly ripened, all the bleeding that usually takes place does little injury.

Saddle Grafting.—This is only applicable to stocks of moderate size, but it is well adapted for standard fruit-trees. The top of the stock is cut into a wedge-shape, and the scion is split up the middle, and placed astride on it, the inner barks being made to join on one side of the stock, as in cleft grafting. The tying, claying, &c., are of course performed in the usual manner.

Side Grafting.—This is nothing more than splice grafting performed on the side of a stock, the head of which is not cut off. It is sometimes practised on fruit-trees to supply a branch in a vacancy, or for the sake of having

different kinds of fruits on the same tree ; but it is better for the latter purpose to graft on the side-branches, because, in consequence of the flow of the sap not being interrupted by being headed down, the success of this kind of grafting is more uncertain than almost any other mode. In grafting the lateral branches of fruit-trees, it is always desirable, in order to insure success, to have corresponding buds in the scion and the stock.

Wedge Grafting. — This is simply a modification of side grafting.

Root Grafting. — Root grafting is merely the union of a scion to a root, instead of to a stem. It is sometimes practised in nurseries, by grafting the apple and the pear on the roots of thorns, tree pæonies on herbaceous pæonies, &c.

Herbaceous Grafting. — This is applicable either to the solid parts of herbaceous plants, or to the branches of ligneous or woody plants, when they are in an herbaceous state. By this method the melon has been grafted on the cucumber, the tomato on the common potato, the cauliflower on the broccoli and the borecole, &c. To do this, choose a vigorous part of a shoot having a well-developed leaf. In the axil of this leaf an oblique cut is made, of half its thickness. The point of a melon shoot, so far developed as to have its fruit quite formed, is then cut off, and pointed at its end, two inches below the fruit. It is inserted in the cleft made in the stock, always taking care to spare the leaf until the scion has taken. The remaining part of the operation is performed with ligatures and grafting-wax.

Grafting by Approach, or Inarching. — This differs from grafting by detached scions, in the scion or shoot not being separated from the plant to which it belongs, and by which it is nourished, till a union takes place. For this purpose, it is necessary that the two plants which are to form the scion and stock be planted, or, if in pots, placed adjoining each other, so that a branch of the one may be easily brought into close contact with the stem, or with a branch, of the other. A disk of bark and alburnum is then removed from each at the intended point of union, and the parts being properly fitted to each other, so as the inner barks of the respective subjects may coincide, as in the case of grafting by detached scions, they are bandaged and covered with clay or grafting-wax. This being done, in a short time, in consequence of the development of the secretion called cambium, the alburnum of the scion and that of the stock become united, and the scion may be cut off below the point where it is united with the stock, leaving the former to be nourished only by the latter.

The principal use of grafting by approach is to propagate plants of rarity and value which it is found difficult to increase by any other means, and of which it is not desirable to risk the loss of any part, by attempting an increase by means of detached scions or cuttings.

II. BUDDING.

Uses of Budding.—Budding, or grafting by detached buds, consists in transferring a portion of bark containing one or more buds, and forming the scion, to the wood of another plant, forming the stock, a portion of the bark of the stock being raised up or taken off to receive the scion. The buds of trees are originated in the young shoots in the axils of the leaves, and when the bud begins to grow, its connection with the marrow sheath ceases; or, at all events, the bud, if detached and properly placed on the alburnum of another plant, will become vitally united to it. On these facts the art of budding is founded.

This mode of grafting is chiefly applicable to woody vegetation, and the scion may, in general, be secured to the stock, and sufficiently protected there, by bandages of bast mat, or thread, without the use of grafting-clay or wax. The union between the scion and the stock takes place, in the first instance, in consequence of the exudation of organizable matter from the soft wood of the stock; and it is rendered permanent by the returning sap from the leaves of the stock, or from those of the shoot made by the bud. All the different modes of budding may be reduced to two;—*shield budding*, in which the scion is a piece of bark, commonly in the shape of a shield, containing a single bud,—and *flute budding*, in which the scion consists of a ring or tube of bark, containing several buds. In both modes, the bark of one year is chosen in preference; and the operation is more certain of success when the bud of the scion is placed exactly over the situation of a bud on the stock. The shield may, however, be placed on the internodes, or a piece of bark without buds may be put on as a scion, and yet a vital union may take place between the parts, because the marrow rays exist everywhere in the wood, and it is by them, during the process of organization, that the layer of wood of one year, in a growing state, is joined to that of the year before. When the bud is placed on the stock, its point is almost always made to turn upwards, as being its natural position; but, in budding trees which are liable to gum, the bud is made to point downwards. There are two seasons at which budding is practised, namely, when the sap rises in spring; when the bud inserted is developed immediately, in the same manner as in detached ligneous scions; and in the end of summer, when the sap is descending, the operation being then performed with a bud formed during the preceding summer, which does not develop itself till the following spring. In budding, the stock is not generally cut over in the first instance, as in grafting by detached ligneous scions, but a tight ligature is frequently placed above the graft, with the intention of forcing a part of the ascending sap to nourish the graft.

The uses of budding, in addition to those of the other modes of grafting, are, also, to propagate some kinds with which the other modes of grafting are not so successful; to perform the operation of grafting with greater rapidity than with detached scions, or inarching, as in the case of most fruit-trees, to unite early vegetating trees with late vegetating ones, — as the apricot with the plum, they being both in the same degree of vegetation during the budding season; to graft without the risk of injuring the stock in case of want of success, as in side budding, and in flute budding, without heading down; to introduce a number of species or varieties on the same stem, which could not be done by any other mode of grafting without disfiguring the stock, in the event of the want of success; to prove the blossoms or fruits of any tree, in which case blossom-buds are chosen instead of leaf-buds; and finally, as the easiest mode of distributing a great many kinds on the branches of a tree, as in the case of roses, camellias, and fruit-trees.

Performing the Operation. — In performing the operation, mild, cloudy weather should be chosen, because, during hot, dry, windy weather, the viscous surfaces exposed to the air are speedily dried by evaporation, by which the healing operation is retarded; besides, the bark never rises so well as it does in weather which is still, warm, and cloudy, but without rain. The first step is to ascertain that the bark of the scion and that of the stock will separate freely from the wood beneath them; then procure the cutting from which the shields or tubes of bark are to be taken. If the budding is to be performed in spring, the cuttings from which the buds are to be taken should be cut — always using the proper kind of knife — from the tree the preceding autumn, and kept through the winter, by burying their lower ends in the ground, in a cool, shady situation, as in the case of grafting by detached scions. When these cuttings are to be used, their lower ends should be placed in water, to keep them fresh while the operation of cutting shields or rings from them is going on. If, on the other hand, the budding is to be performed in summer, then the cutting from which the buds are to be taken is not to be cut off the parent tree till just before the operation is to be performed. The cutting should be a shoot of the current year's wood, which has done growing, or nearly so, and its leaves should be cut off, to prevent the waste of sap by evaporation, as soon as it is taken from the tree; the end of the cutting should then be put in water to keep it fresh, and the buds taken off as wanted. When the leaves are cut off, care should be taken to leave part of the petiole of each, to handle the shield or ring by when putting it on the stock. A slit is next made in the stock, or a ring of bark taken off; and the shield or ring from the cutting, containing a bud or buds which are ripe or nearly so, is introduced in the manner which will presently be described. Tying the bud on

the stock generally completes the operation, though sometimes grafting-wax is employed to cover the junction of the shield or ring.

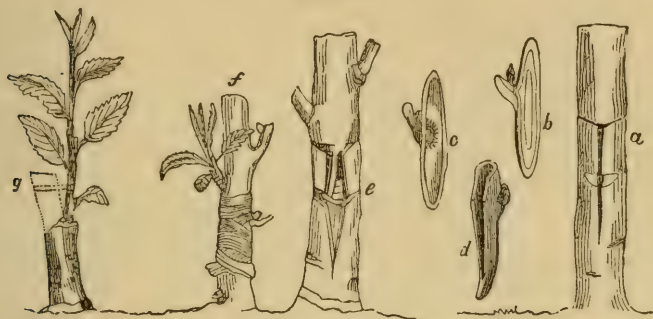
Transmitting Scions. — Scions for budding may be sent a considerable distance by letter, if the leaves are cut off and the scion closely wrapped up in oiled paper, or coated over with mastic. They may also be left for several weeks, by immersing them in honey. When bulk is not an objection, they may be packed up in long grass, or in moist moss, or in several folds of moistened brown paper, and covered with drawn wheat-straw, to serve as a non-conductor of heat and moisture.

Wax for Budding. — Prepared wax for budding may be composed of turpentine, bees-wax, resin, and a little tallow, melted together. It may be put on in the same manner as grafting-clay, but should not be more than a quarter of an inch in thickness; or it may be very thinly spread on cotton cloth, and used in shreds, like sticking-plaster. In this last state, it serves both as a ligature for retaining the scion in its place, and as a covering for excluding the air. In very delicate budding or grafting, fine moss or cotton wool is frequently used as a substitute for grafting-clay or grafting-wax, the moss or cotton being tied firmly on with coarse thread or fine strands of bast matting. Plastic wax, or grafting-wax, which the heat of the hand, or breathing on, will render sufficiently soft for use, is thus prepared: — take common sealing-wax, — of any color, except green, — one part; nut-ton fat, one part; white wax, one part; and honey, one eighth of a part. The white wax and the fat are to be first melted, and then the sealing-wax is to be added gradually, in small pieces, — the mixture being kept constantly stirred; — and lastly, the honey must be put in just before taking it off the fire. It should be poured hot into paper or tin moulds, and kept slightly agitated till it begins to congeal.

Shield Budding. — This is about the only mode in use in British nurseries, where it is generally performed in July or August. A cross cut and slit are made in the stock, in the form of the letter T, and if possible through a bud. (Fig. 332, *a*.) From a shoot of the present year deprived of its leaves, a slice of bark and wood, containing a bud, *b*, is then cut out, and the wood is removed from the slice by the point of the knife. This is done by holding the shield by the remains of the leaf, with one hand, and entering the point of the knife at the under extremity of the shield, and between it and the thumb; and then raising and drawing out the wood by a double motion outwards from the bark, and downwards from the upper to the lower extremity of the shield. The bud being now prepared, as at *c*, the bark on each side of the slit in the stock is raised up by the spatula end of the budding-knife, and the shield inserted beneath it; its upper part being cut straight across, as at *d*, so as to admit of its joining accurately with the

inner bark of the stock, as at *e*, so as to receive its descending sap. A bandage of soft matting is now applied, so as to exclude the air from the wounded parts, and to show only the bud and the petiole, as at *f*, and the

Fig. 332.



operation is complete. At *f*, the bud is shown developing its leaves, and at *g* it has produced a shoot of some length, which is tied for a short time to the upper part of the stock; but that part of the latter which is shown by dotted lines is cut off in July.

The portion of wood left attached to the base of the bud should generally be about a third of the length of the shield; the latter being from an inch to an inch and a half in length, and the eye should be situated about a third from the top. Spines, prickles, and leaves should be carefully cut off, or shortened. Sometimes, in taking out the splinter of wood from the scion, which is done with a quick, jerking motion, the base of the bud, which is woody, is torn out also, leaving a small cavity, instead of an even surface; the surface, when the bud is in a proper state, being either quite even, or only gently raised above the surrounding bark, in consequence of the woody base of the bud being left in. When this latter has been torn out, so as to leave a cavity, it is safest not to use the bud, but to prepare another; though, when the cavity left is not very deep, and a small portion of wood is seen in it, the bud will sometimes grow. Only those buds must be taken from the scion that are nearly mature, which is readily known both by the size of the bud and by the full expansion and firm texture of the disk of the leaf, in the axil of which it grows.

Shield Budding without a Bud or Eye. — This is used simply to cover a wound or blemish in one tree by a portion of the live bark of another.

Circular Shield Budding. — Budding with a circular shield, with a portion of wood attached, is employed to equalize the flower-buds over a tree, by

removing some from places where there are too many to other places in which there are too few. With the point of a penknife, in spring, cut a small cone of bark and wood containing a bud, and insert it in an orifice made in the same manner, securing the edges with grafting-wax. *Budding with a shield stamped out by a punch* is considered excellent for budding old trees, the thick and rugged bark of which is not suitable for being taken off with the budding-knife. With a mallet the punch is driven through the bark of the scion, and then through that of the stock, and the piece which comes out of the former is inserted in the cavity formed by the piece taken out of the latter. *Shield budding with a terminal bud* is supposed to produce a more vigorous shoot than when a lateral eye is used, and it is, therefore, recommended for supplying a leader to a shoot that has lost one.

Flute Budding. — There are several modifications of this mode of budding, which is a good deal used, in some countries, for trees that are difficult to take, — such as the walnut and the chestnut, — and for several oaks, as well as for the white mulberry.

Annular Budding. — This is performed either at the principal movement of the sap in spring, or at the end of its principal movement in August. In either case, the top of the stock is kept on; and if the ring of bark containing a bud or buds taken from the scion is larger than the space prepared for it on the stock, a piece must be taken from it longitudinally, so as to make it fit exactly.

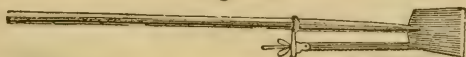
After-care. — The after-care of grafts by budding consists, in all cases, in removing the bandages or plasters as soon as it is ascertained that the buds or scions have adhered to the stock. This may generally be known in two or three weeks, by the healthy appearance of the bark and its bud or buds, and by the dropping off of the petiole, which, in the case of the bud, withers and adheres. The next operation is to head down the stock to within an inch or two of the bud, — the stump being left for a week or two as a prop, to which the shoot produced by the bud of the scion may be tied, till it acquires vigor enough to support itself. The stump is then cut off in a sloping direction, close above the bud. In general, any buds which develop themselves on this stump should be rubbed off; but in the case of very weak scions, one or more buds may be left on the stump, to draw up the sap till the graft has taken. When budding is performed in spring, the stock should have been headed down before the ascent of the sap; but in autumn budding, as no shoot is produced till the spring following, heading down is deferred till that season, and takes place just before the sap is in motion. Where a number of grafts by buds are introduced on one stem or on one branch, heading down can, of course, only take place above the uppermost

bud; and in terminal flute budding, it is performed as a necessary part of the operation.

III. PRUNING.

Uses of Pruning. — Pruning consists in depriving a plant of a portion of its branches, buds, leaves, bark, or roots, in order to produce particular effects on the part of the plant which remains. The different kinds of pruning may be included under knife-pruning, which is applied to small branches; lopping, which is applied to large branches; clipping, which is applied to small shoots in masses; and disbudding, disleafing, and disbarking, which are applied to buds, leaves and bark. Girdling and felling may also be included. The instruments necessary for these operations are chiefly the pruning-knife, the bill, the saw, the cutting-shears, and the clipping-shears; but there are some other instruments, such as the pruning-chisel, the girdling-machine, &c., which are occasionally used for peculiar purposes. The approved pattern of pruning chisels is seen in the following cut.

Fig. 333.



Pruning Forest-trees. — In forest-trees pruning is of the greatest use in modifying the quantity of timber produced. Thus, by commencing when the tree is quite young, and shortening the side-branches and encouraging the leading shoot, the whole of the timber produced is thrown into the main stem. On the other hand, should crooked timber be desired, pruning by destroying the leading shoot, and encouraging those that have a suitable direction, tend to attain the end in view; and, by the aid of training, this end can be completely effected. Trees which are stunted in their growth, from being hide-bound (a disease which is brought on by the sudden exposure of the trees to the weather after they have been drawn up by shelter, and, in the case of young trees, by being planted of too large a size in proportion to their roots), may in general be made to shoot vigorously by being cut down or headed in. Again, trees which are in particular situations, where it is feared they will grow too large, may be arrested in their growth, or stunted, by amputating the larger roots.

Pruning Ornamental Trees. — This is chiefly employed to remove diseased branches, because much of the effect of these trees depends on the development of their natural form and character.

Pruning Ornamental Shrubs. — Those which are grown for their flowers produce them of much stronger and brighter colors when the shoots are

thinned out, or shortened, or both ; and it is useful when the plants are prevented from exhausting themselves by the removal of decaying blossoms, so as to prevent them from maturing their seeds. A pair of pruning-scissors are useful in case of rose-bushes, &c.

Fig. 334.



Pruning Fruit-trees and Shrubs.— These, above all other plants, are benefited by pruning, which is indeed by far the most important part of their culture. The most general object of pruning is to create an abundant supply of sap during summer, by the production of leaf-shoots, by which the general strength of the tree is augmented, and to limit the distribution of this sap when it ascends from the roots in the following spring, by diminishing the number of buds. The effect of this is to increase the vigor of

Fig. 335.



Fig. 336.



Fig. 337.



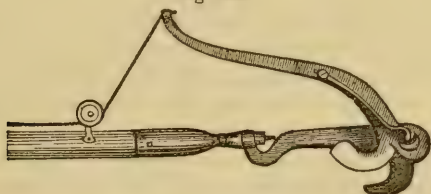
Fig. 338.



the shoots or fruits produced by these buds ; and if this be done in such a manner as to obtain also the greatest advantages from light and air, the pruning will have answered its purpose. If a fruit-tree were not deprived every year of a part of the wood or the buds which it produces, its shoots and fruits would gradually diminish in size, and though the fruit would be

more numerous, it would be deficient in succulence and flavor, as is found to be the case in old neglected orchard-trees. The application of pruning to fruit-trees differs so much, according to the species of tree, that the subject can only be properly treated by taking each class separately. Thus kernel-fruits, which are produced on wood of two or more years' growth, require to be pruned in a different manner from such fruits as the peach, which is produced from the shoots of the current year. The production of blossoms, or the enlargement of fruits and the acceleration of their maturity by ringing, is a species of pruning peculiarly applicable to fruit-trees. In pruning high branches, an instrument called an avarrancator — pole pruning shears — is found to be very convenient. See Fig. 339.

Fig. 339.



Pruning Herbaceous Plants. — To herbaceous plants pruning is applicable, not only when they are being transplanted, when both roots and top are frequently cut in, but also to fruit-bearing kinds, such as the melon tribe, the tomato, &c. It is even useful to the cabbage tribe, when it is wished that, after the head is cut off, the stem should throw out sprouts, which is found to be accelerated by splitting it down an inch or two. The topping of beans, and the picking off of potato-blossoms, are operations belonging to pruning, as are the cutting off of withered flowers for the sake of neatness, &c.

DIFFERENT KINDS OF PRUNING.

These may be included under close pruning, shortening-in, fore-shortening, spurring-in, heading-in, lopping, snag-lopping, lopping-in, stopping, pinching-out, disbarking, disbudding, disleafing, slitting, bruising or tearing, root-pruning, girdling, and felling.

Close Pruning. — This consists in cutting off shoots close to the branch or stem from whence they spring, leaving as small a section as possible, in order that it may be speedily healed over. In performing the operation, care should be taken to make the wounded section no larger than the base of the shoot, in order that it may be healed over as quickly as possible; and at the same time to make it no smaller, because this would leave latent buds, which would be liable to be developed, and thus occasion the operation

to be performed a second time. This mode of pruning is only adopted where the object is to produce stems or trunks clear of branches, or of any kind of protuberance, as in the case of standard trees in gardens, especially fruit-trees, and in the case of forest-trees grown for their timber. If the branch cut off is under an inch in diameter, the wound will generally heal over in two seasons, and in this case the timber sustains no practical injury; but if it is larger, it will probably begin to decay in the centre, and thus occasion a blemish in the timber.

Shortening-in. — This term is applied when side-shoots are shortened at the distance of from two to four or five feet from the stem, the cut being always made to a bud. Exceeding that distance, it is called *fore-shortening*, and is chiefly applicable to timber-trees in hedge-rows; and under that distance it is called *spurring-in*. In the culture of fruit-trees, it is applied in connection with spurring-in, to produce trees of conical forms, with branches which, never being allowed to attain a timber size, are prolific in fruit-bearing spurs. Whenever the branches exceed two inches in diameter, they are cut off within an inch of the stem, and one of the young shoots which are produced there is trained to take its place.

Fore-shortening. — When the lateral branches of a standard tree extend further than is desirable, a portion of their extremities is cut off; the cut being always made close above a branch of sufficient thickness to form a leader of sufficient strength to keep the branch alive and healthy, but not so strong as to cause it to produce much timber, or in any way to come into competition with the trunk of the tree. The object is to prevent the lateral branches of the trees from injuriously shading the plants under them; and hence it is chiefly used in the case of trees in hedge-rows.

Spurring-in. — The apple, the pear, the cherry, the plum, and other fruit-trees, or fruit-shrubs, produce what are called spurs, or very short shoots or knobs, covered with blossom-buds, naturally; and the object of spurring-in pruning is to produce these knobs artificially. This can only be done with lateral shoots, to which the sap is not impelled with the same vigor as to the growing point, because the great object in producing spurs is to obtain blossom-buds, and these are never produced on the most vigorous shoots. A lateral shoot of the present year being produced, may be shortened to two or three visible buds, either in the beginning of summer, after that shoot has grown a few inches in length, or in the following winter; but the former is in general the better season, because it is not desirable to encourage the production of wood, and, consequently, of sap, but rather to lessen their production, so as to produce stunted branches, which are, in fact, the spurs. The second and third years the shoots produced are shortened in the same manner as they were the first, and it will

generally be found that the leaf-buds left on the lower ends of the shoots, when cut down, will the year after become blossom-buds. As by the process of continually shortening the shoots the spurs in a few years become inconveniently large, they are, from time to time, cut out, and new spurs formed by the same process as before; and finally, after a certain time, the entire branch bearing the spurs is cut out close to the main stem of the tree and renewed, as spurs are, by a young shoot produced from its base. It must be confessed, however, that pruning has but little to do with the production of spurs that are prolific in blossoms; that depends far more on adjusting the nourishment supplied by the root to the demands of the fruit-bearing branches, to the mode of training, the kind of tree, and other particulars, which, when attended to, spurs are produced naturally.

Heading-in. — This is cutting off all the branches which form the head of a tree close to the top of the stem, leaving, however, their base to produce buds. This is done with what are called polled or pollard trees periodically, for the sake of the branches produced as fagot or fence wood, and with fruit-trees when they are to be regrafted. It is also done with stunted

Fig. 340.

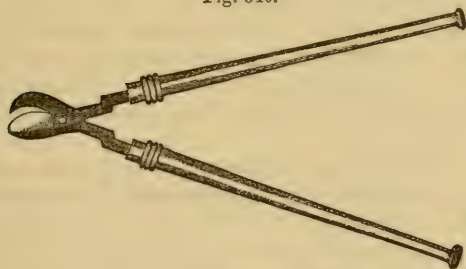
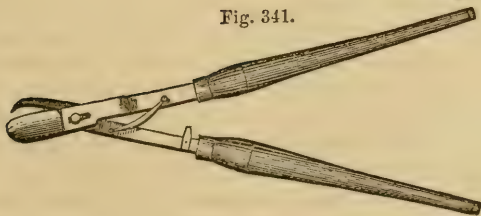


Fig. 341.



forest-trees, for the sake of concentrating the sap into a few main shoots, instead of distributing it over a great many; and it is done in transplanting trees of considerable size, intended to form avenues, or single trees in parks. The branches, if under two inches in diameter, are cut off clean with a bill

at one stroke ; or, if they are larger, they are first sawn off, and afterwards the section is made smooth with the bill-axe or the knife, but generally with what is called the bill-knife.

Lopping.— This term is very generally applied to heading-in, but it is also as generally used to signify the cutting off large branches from the sides of stems, and in this sense we shall here treat of it. Lopping is performed in three manners, two of which are highly injurious to the timber of the trunk of the tree, and the other not so. The close and snag lopping are the modes which are injurious ; the only mode of lopping large branches from the sides of the trunks of trees, without injuring the timber in these trunks, is to shorten them to a branch of sufficient size to heal the wound at its base, or, at all events, to maintain the growth of the whole of the part of the branch left, and prevent decay from reaching the trunk. This mode is called *lopping-in*. Fig. 340 represents one of the lopping or branch shears, and Fig. 341 the sliding pruning-shears.

Cutting Down.— Cutting down the stem or trunk of a tree to the ground is an important operation, because, in some cases, such as that of resinous or needle-leaved trees, it kills the tree, while in others, or what are called trees that stole, which is a property of most broad-leaved trees, it affords the means of renewing the tree. Fruit-trees cannot generally be so treated, because the graft is for the most part only a few inches above the surface of the soil ; but even with fruit-trees, when they are stunted, there is no better mode of restoring them to vigor than by cutting them down to the graft.

Stopping and Pinching-out.— When the point of a shoot is cut off, or pinched out, while that shoot is in a growing state, it is said to be stopped ; that is, the shoot is prevented from extending its length, and the sap, which was before impelled to its growing point, is now expended in adding to the largeness or succulence of the leaves or fruits which may be on the shoot, or in swelling or developing the buds, or in some cases changing them from leaf-buds into flower-buds. The principal uses of stopping, however, are to promote the setting and the swelling of the fruit, either on the shoot of the current year, as in the case of the vine and melon, or at its base, as in the case of the peach. Much of the winter pruning of trees might be prevented by stopping the shoots early in summer, provided the state of the tree did not require that the shoots should be allowed to grow their full length, in order to send down nutriment to the increase of the roots, in consequence of which greater vigor is in turn imparted to the stem and branches. In this case of pruning, as in every other, the state of the tree, and a variety of circumstances connected with it, require to be taken into consideration.

Disbarking.— This includes two distinct operations,—the removal of

coarse, loose, outside bark, to admit of the swelling of the inner bark and the alburnum by the returning sap, and the removal of a ring of both inner and outer bark, with a view to the interruption of the returning sap. The removal of old bark is an operation chiefly performed with old fruit-trees in orchards, for the sake partly of getting rid of lichens and mosses, and partly to remove crevices which might harbor insects. It is also practised on the stems of old vines for the latter purpose; one effect of removing the loose outer bark of any stem being to increase its susceptibility of suffering from changes of temperature and moisture, it may therefore often be more injurious than useful. Disbarking for the tanner consists in removing the whole of the bark, and is best performed in spring, when, in consequence of the abundance of ascending sap, the bark separates easily from the wood. *Scraping* trees, to keep them clean, is also considerably practised.

Ringing. — This operation consists in taking off a narrow ring of bark from a stem or branch, or even from a root, the object of which is to check the returning sap, and force it to expand itself among the leaves, flowers, or fruit, which are situated above the incision. The ring of bark taken off varies in width from a sixteenth to half an inch or an inch, and its depth is always equal to that of both outer and inner bark. In general, the width of the ring taken off should not be greater than the tree has the power of re-covering with bark, during the same or the following year. The operation may be performed at any season, but its effects will only be rendered obvious when the plant is in leaf, because at other seasons there is little or no sap elaborated to be returned. Compressing the bark by a ligature of wire or cord, or by a mass of Roman cement, put on like the clay of a graft, produces the same effect as ringing. In the case of fruit-trees, it is frequently executed on the branches to produce blossom-buds, and by the same means seedling plants are sooner thrown into blossom than they otherwise would be. It has little effect on stone fruits; and while it succeeds on the gooseberry, it is said not to do so on the currant. Judiciously applied, it may often serve as a substitute for root pruning and top pruning.

Disbudding. — This is the removal of buds early in spring, just when they are beginning to develop their leaves; and is commonly performed with the finger and thumb, the object being to lessen the number of shoots or of blossom-buds to be produced. By lessening the number of blossom-buds, it will add to the strength and probability of setting of those which remain, and the same increase of strength will take place in respect to the shoots. whilst, at the same time, the number of these is reduced to an approximation of that which can ultimately be retained for training. By applying this mode of pruning judiciously on such trees as the peach, apricot, and plum, especially when trained against walls, the use of the knife may be in a great

measure dispensed with, excepting for cutting out diseased or decaying shoots. In removing the buds, care should be taken not to injure the bark of the shoot. The buds ought not to be all disbudded at the same time; the fore-right ones should be first removed, and the others successively, at intervals of several days, in order not to check the circulation of sap by a too great privation of foliage at once.

Disleafing. — By taking the leaves off a growing shoot as fast as they are unfolded, no buds are matured in their axils; and thus, while the superfluous vigor of the tree is expended, no sap is returned to the root. Disleafing in this manner the summer's shoots of a tree, as they proceed in growth, has been found the simplest mode of reducing the strength of an over-luxuriant tree. When a tree fills the space allotted to it against a wall, and shows a disposition to still further growth, by throwing up strong vertical shoots above the wall, and luxurious breast-wood on the main boughs, instead of checking this disposition by any of the ordinary modes of pruning, some gardeners assist the tree to throw off the superabundant sap, by disleafing the breast-wood and vertical shoots, and in the winter pruning all the buds on such shoots as are displaced, even those on the points, after which they die off by degrees, and are cut out. Disleafing is frequently practised with fruit-bearing plants, both woody and herbaceous, with a view to admit the sun and air to the fruit, and sometimes also to assist in ripening wood by stopping growth.

Slitting and Splitting. — These may be classed under modes of pruning, the first being occasionally employed to relieve hide-bound trees, — a practice of doubtful utility, — and the second to stimulate the stems to the production of roots or shoots. Hide-bound trees are relieved by slitting the bark longitudinally from the collar as high up the stem and along the branches as may be considered necessary. The lower extremities of cuttings are sometimes slit up, and shoots are split or fractured to excite buds.

Bruising and Tearing. — Bruising and tearing off the stems of plants from their roots are in some cases found to be more effective than cutting them off with a smooth section. A very full crop of pears has been obtained from trees which before had not borne at all, by twisting and breaking down the young shoots late in the autumn, when the wood had become tough, and after the sap had retreated. This practice has been found successful with branches on which ringing had been tried without success, and the pendent branches continued perfectly healthy.

Clipping. — This is confined chiefly to common hedges and box edgings.

Root Pruning. — As the nourishment of a plant is absorbed from the soil by the roots, it is evident that the supply will be diminished by partially cutting off its source. The effect of cutting through the stronger roots of trees

is analogous in its first effects to that of ringing ; with this difference, that the returning sap is stagnated throughout the whole tree, instead only in the parts above the ring. The immediate effect is to check the luxuriance of wood-shoots, and induce the formation of fruit-buds. The operation, however, should not be carried so far as to reduce too much the vigor of the tree, and prevent the second result, — that of pushing a number of fibrous roots from those amputated ; for, in defect of these, the health of the tree must decline under the load of, in that case, imperfectly nourished fruit. With a view to the production of a greater number of fibrous roots, old trees may be subjected to a cautious root pruning ; but it must not be performed on subjects unable to bear the shock, or on those in which the power of throwing out fresh roots is very weak. If, however, it is found that fresh roots have been emitted from one amputation, others may be performed, as the roots resulting from each preceding operation come into action. Root pruning is generally performed with a sharp spade, and generally only on the main roots, at the distance of several feet from the stem, according to the magnitude of the tree. Though this mode is chiefly employed to check the luxuriance of young fruit-trees and throw them into blossom, yet it may be employed for these purposes with all trees and shrubs whatever.

Girdling and Felling. — This is very common in this country, not for the sake of improving the timber, but to destroy life and facilitate the destruction of the tree. It is strongly recommended to disbark trees in the spring, before they are to be felled, and the effect of this, in hardening the timber, is very great ; but, in a hot summer, the exposed alburnum is apt to split more or less. A better mode has been found to be that of merely cutting out clean a rim, about four inches in width, of the bark, close to the ground. By girdling, the whole of what would otherwise be mere alburnum becomes similar to the heart-wood, and this may be one reason why the boards made from such trees are found not to warp. Larches are particularly susceptible to this process.

Seasons for Pruning. — The seasons for pruning vary according to the object in view. Where wood is to be cut out or buds removed, so as to throw strength into the remaining parts of the tree, the sooner the operation is performed, after the fall of the leaf, the better ; because, as the sap is more or less in motion, and consequently impelled to all the buds, throughout the whole of the winter, that which would have been employed on the shoots and buds cut off is saved, and those which remain are invigorated by it. Next to autumn, — according to the opinions of some of the most experienced growers, — winter is to be preferred, for the same reason ; but in this season mild weather is always to be chosen, because the frost, if severe, will seize on the moisture of newly-made wounds, and rupture their surface.

The worst season in which any description of wood pruning can be performed is the spring, just before the expansion of the leaves, when the sap is rising with the greatest vigor. The slightest wound made in many plants, both woody and herbaceous, at this season, especially young, vigorous ones, where the sap-vessels are large, occasions a great loss of sap, which must necessarily weaken the plant, unless speedily checked by the only effectual mode in which this can be done, the expansion of the leaves. For disbudding and ringing, spring is the most suitable season, — at least, for the latter practice, for nothing is gained by ringing before the leaves begin to expand. Buds which are to be removed should remain as short a time as possible after they are formed by the leaves; but as the labor is much greater in taking them off in autumn and winter, when they are small, than in spring, when all their parts are more or less expanded, the operation is generally deferred till the latter season. For disleafing, it is necessary to commence as soon as the leaves begin to expand, and continue it as long as they are produced. The advantages of pruning just before midsummer are, that the wounds may be partially healed over the same season, and that the sap which would have been employed in maturing the shoots cut off is thrown into those which remain. The disadvantages are, that the sap which would have been elaborated by the leaves cut off, and which would have added to the strength of the tree and its roots, is lost. In the case of trees already sufficiently strong, this is no disadvantage; but in the case of those which are too weak, it is a positive loss. The summer season is found better than any other for pruning trees which gum, such as the cherry and the plum, provided too much foliage is not thereby taken away; and it is also considered favorable for resinous trees. The autumn, on the other hand, is considered the best for trees that are apt to suffer from bleeding, such as the vine, the birch, and some species of maple.

IV. TRAINING.

Uses of Training. — To train a plant is to support or conduct its stem and branches in some form or position, either natural or artificial, for purposes of use or ornament. It is effected partly by pruning and thinning, but chiefly by pegging down to the ground, tying and fastening to rods, stakes, or trellises, or nailing to walls. The articles more immediately required are hooked pegs, ties, nails, and lists, with props of various kinds, and ladders.

Principles of Training. — The principles upon which training is founded vary according to the object in view, but they all depend more or less on these facts: — that the sap of a plant is generally impelled with the greatest force to its highest point, and that, in general, whatever promotes this tendency encourages the production of leaves and shoots, and whatever represses

it promotes the formation of blossom-buds. When a plant is to be trained over the surface of the ground, it must be borne in mind, that, as the tendency of the sap is always to the highest bud, the shoots pegged down should be allowed to turn up at the points, in order to promote their extension. When the object is to produce blossoms or fruitfulness, a contrary practice should be followed, and the points of the shoots kept down, or, in the case of upright grown plants, trained horizontally, or even in a downward direction. This should also be done when the object is to restrain over-luxuriance, and a contrary practice when a weak or sickly plant or tree is to be invigorated. When the object is to economize space, the plants are trained against a trellis, as occupying length, but very little breadth; and when it is to increase temperature, they are trained or spread out against a wall, which prevents the conducting of heat and moisture from the branches, by acting as a screen against winds, and increases heat, by reflecting the rays of the sun during the day, and giving out heat during the night, and whenever the atmosphere is at a lower temperature than the wall.

Manual Operations of Training. — The tie or the list, by which the shoots are fastened to the wall or trellis, should be placed in the internode, and always immediately behind a bud or joint; because, when tying or nailing takes place in the summer season, and near the points of the growing shoots, the latter sometimes elongate after being fastened, and if this elongation is prevented from taking place in a straight line, by the fastening being made immediately before a bud or leaf, instead of immediately behind it, the shoot will be forced in a curved direction, and the bud and its leaf injured. The bast ties are gently twisted before being tied into a knot, in order that it may be the firmer, and not liable to be torn during the operation of tying. Osier ties, which are frequently used for espalier-trees, are fastened by twisting together the two ends, and turning them down in a manner sooner and easier done than described. In fastening shoots with nails and shreds, when any restraint is required to retain the shoot in its position, the pressure must always be against the shred, and never against the nail, as the latter would gall the shoot, and in stone-fruits generate gum. The shred ought not to be placed in the hollow of a bend in the branch to be attached; for there it is worse than useless. On the contrary, the shreds should be put on so as to pull the external bends inwards towards the direct line in which it is desirable the branch should be trained. Nails an inch in length are sufficient for ordinary branches, but twice that length is necessary for very large ones; they should, in general, be driven into the joints, and not into the backs, because the joints are easily repaired. Shreds of woollen are preferred to those of any other cloth, or to leather, as being softer, and less influenced by the weather. Their length should be such as to contain a shoot double the

size of that for which they are intended, in order that they may never compress the shoots so much as to impede the returning sap, and their breadth may be from half to three quarters of an inch to a whole inch. They should be folded up a little at each end, so that in driving the nail through the shred it will pierce four times its thickness, and be in no danger of tearing.

Training Herbaceous and Shrubby Plants in Pots.—These, being in a highly artificial state, when they require training should have straight rods, or symmetrical frames of laths or of wire-work. A common mode for the grape is seen in the annexed cut; formed of rods and rings of stout wire, the whole being painted according to the taste of the grower.

Fig. 342.

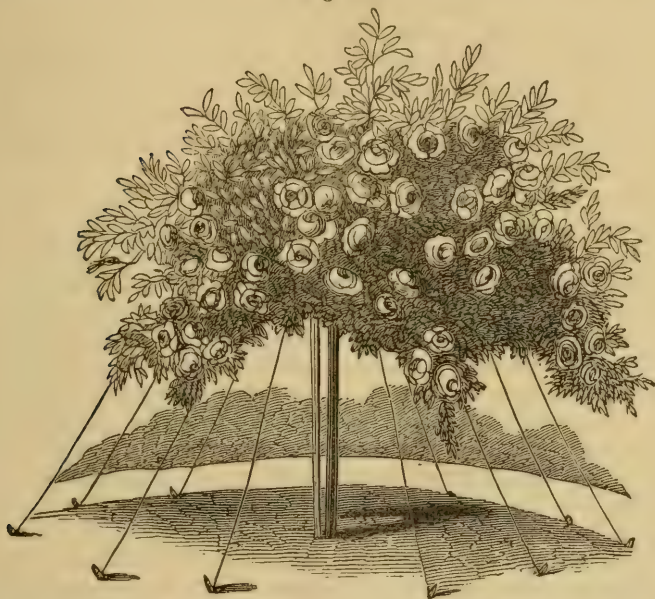


Training Hardy Flowering Shrubs in the Open Ground.—Trailing and creeping shrubs seldom require any assistance from art, excepting when they are made to grow upright on posts, trellises, or walls. The cut which follows represents a climbing rose, trained down from a ring which forms the top to an iron rod. This is called the balloon manner of training, and was first applied to apple-trees. When the rod is fixed in the ground, the ring at the top should stand an inch or two higher than the graft at the top of the stock, or than the head formed on the stem of the plant, if it should not have been grafted. Six or eight of the strongest shoots are then to be selected, and tied to the ring with tarred twine; and if, from their length, they are liable to blow about, their ends are attached to twine, continued from the wire to pegs stuck in the ground, as shown in the figure.

Training Fruit-trees.—By far the most important application of training is to fruit-trees, whether for the purpose of rendering them more prolific, improving the quality of the fruit, growing fruit in the open air which could not otherwise be grown, except under glass, or confining the trees within a limited space. Fruit-trees are trained either as protuberant bushes or trees in the open garden, or spread out on flat surfaces against walls or espaliers.

In either case, the operation is founded on the principle of suppressing the direct channel of the sap, by which it is more equally distributed over the

Fig. 343.



tree, the tendency to produce over-vigorous shoots from the highest part is diminished, and the production of flowers from every part increased. We find that trees in a state of nature always produce their first flowers from lateral branches, to which the sap flows less abundantly than to those which are vertical; and the object of training may be said to be, to give all the parts of a tree the character of lateral branches. With a view to this, certain rules have been derived from the principle of the suppression of the sap, which it may be useful to notice as of general application to every mode of training:—1. Branches left loose, and capable of being put in motion by the wind, grow more vigorously than those which are attached; and hence the rule to nail or tie in the stronger shoots first, and to leave the weaker shoots to acquire more vigor. Hence, also, the advantage of training with fixed branches against walls, as compared with training with loose branches in the open garden, when greater fruitfulness is the object. 2. Upright shoots grow more freely than inclined shoots. Therefore, when two shoots of unequal vigor are to be reduced to an equality,

the weaker must be elevated and the stronger depressed. 3. The shoots on the upper side of an inclined branch will always be more luxuriant than those on the lower side; therefore preserve, at the period of pruning or dis-budding, only the strongest shoots below, and only the weakest above. 4. The lower branches of every tree and shrub decay naturally before the upper branches; therefore bestow the principal care on them, whether in dwarf bushes in the open garden, or with trees trained on espaliers or walls. When they are weak, cut them out, and bring down others to supply their place; or turn up their extreme points, which will attract a larger portion of sap to every part of the branch.

Different Modes of Training Bushes and Trees in the Open Garden.— These are chiefly the conical form for tall trees or standards, and some modification of the globe or cylinder for dwarfs; but it may be remarked that unless these and all other artificial forms are constantly watched, to check the tendency to return to nature, they are much better dispensed with. By careful attention, some of these artificial forms will bring trees sooner into a bearing state, and a greater quantity of fruit will also be produced in a limited space; but if the continued care requisite for these objects is withdrawn for two or three years, the growth of the tree, while returning to its natural character, will produce a degree of confusion in the branches that will not be remedied till all the constrained branches have been cut away. Wherever, therefore, fruit is to be grown on a large scale, and in the most economical manner, in orchards or in the open garden, it is found best to let every tree take its natural shape, and confine the pruner and trainer to such operations as do not greatly interfere with it. These are chiefly keeping the tree erect with a straight stem, keeping the head well balanced, and thinning out the branches where they are crowded or cross each other, or become weak or diseased. There are, however, many persons who have small gardens, and who have leisure or means to attend to all the minutiae of culture; and to these some of the modes of training protuberant dwarfs and standards may be of considerable importance, by bringing the trees into a bearing state sooner than would be the case if they were left to nature, and by producing much fruit in little space.

Different Modes of Training Fruit-trees against Walls or Espaliers.— These may all be reduced to three forms or systems:— the fan or palmate form, which is the most natural mode, and that most generally applicable; the horizontal system, which is adapted to trees with strong stems, and of long duration; and the perpendicular system, which is chiefly adapted to climbers, such as the vine. Trees trained by any of the preceding modes, against a wall or espalier, are much more under the control of art than can ever be the case with trees or bushes in the open garden; because, in the

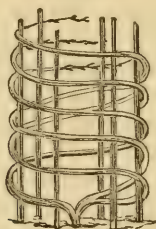
latter case, the whole tree, as well as its branches, is at all times more or less liable to be put in motion by the wind, whereas against a wall they are fixed, and have not the aid of motion to increase their thickness. For these reasons, and also because flat training is applied to trees which, as protuberant bushes in the open garden, would scarcely produce fruit at all, flat training cannot be dispensed with. In making choice of a mode of flat training, the nature of the tree, the climate, soil, and the object in view, must be jointly taken into consideration. Trees of temporary duration, which naturally produce numerous divergent branches, such as the peach and the apricot, are best adapted for fan training, where the climate is favorable; but in a cold climate an approach to the horizontal manner may be preferable, by lessening the quantity of wood produced, and thus facilitating its ripening. The horizontal system of training produces the greatest constraint on nature, and is therefore adapted for fruit-trees of the most vigorous growth, and of large size, such as the pear and apple, which are almost always trained in this manner, whether on walls or espaliers. For plants producing shoots having little or no tendency to ramify, and which are of comparatively short duration, the perpendicular manner is the most natural and the easiest; nevertheless, by disbudding and training, plants of this kind can be made to assume the fan form, and thus be rendered more productive in blossoms and fruit than if trained in a manner which is more natural to them; and in the case of the vine, even the horizontal system may be adopted, because its shoots are of great duration.

Training Dwarfs in the Open Garden.—These are trained in the form of hollow bushes, concave, or shaped like cups, urns, goblets, or barrels, the form being, in every case, produced by training the shoots to a framework of rods and hoops. Dwarfs are also trained in the form of globes, balloons, cylinders, low cones, pyramids, triangles, and sometimes with the branches in regular stages, like a girandole. All dwarfs, whether to be left to nature or trained artificially, are grafted on stocks naturally of humble growth, such as the quince or the mountain-ash for the pear, &c., &c.

Spiral Cylinders.—Prune and manage the tree so that it shall form from three to six branches, of as nearly equal size as possible, within about six or eight inches of the ground; and as soon as the branches are grown from three to five feet long, fix six rods, or stakes, into the earth, for supporting them, in a circle about the root. Each branch is then to be brought down, and being fixed to the rod near its base, the branch is to be carried round in a spiral manner, on such an elevation as will form an inclination of about fifteen degrees, and each branch is to be fixed in the same manner, one after another; thus all will move in the same direction, one above the other, like so many cork-screws following in the same course, as shown in the annexed

figure. As, from this position of the branches, the point bud of each leader will present the most vertical channel for the sap, the strongest shoot will form there, and thus afford the means of continuing the leaders to a great height, and for a great length of time, without crossing or obstructing each

Fig. 344.



other, or throwing out useless collaterals; at the same time, by the depressed position of the leading branches, enough sap will be pushed out on their sides to form and maintain vigorous fruiting spurs. As trees trained in this manner need never exceed the bounds allotted them on a border or bed, a greater number of trees may be planted, and a greater quantity of fruit produced, in a given space, than can be the case when they are trained in any other manner. But as pear and apple trees on free stocks may be found to grow too rude and large, after a few years, those best answer which are grafted on dwarf-growing stocks. However, to keep dwarf trees from growing too luxuriant and rude, it is a good practice to take them up and replant them every three or four years; if this be done with due care, as soon as the leaves are off the trees in the fall of the year, it will not injure them, nor prevent them bearing a full crop of fruit the following year.

Spurring-in.—Choose a tree that has a leading shoot in an upright direction; having planted it, shorten the side shoot, leaving only two or three buds, and shorten also the leading shoot, according to its strength, so that no more buds may be left on it than will produce shoots. The first summer there will be a produce of shoots, and if before mid-summer the leading shoot be shortened, it will probably throw out side shoots the same season. At the winter pruning, all the side shoots may be shortened to two or three buds, and the leading shoot to such a number as it is believed will be developed. These are to be shortened, and the process of shortening is to be repeated every year, till the tree has the appearance of Fig. 345; or until it has attained the height required, or which the kind of tree is calculated to attain.

Fig. 345.



Conical Standards. — Conical standards, or, as they are erroneously called, pyramidal standards, may be produced from trees partially spurred-in, but

Fig. 346.



the most general mode is, to cut in the side branches ; after passing through

several successive stages, the tree is brought to its regular shape, and the same tree, with the branches of the current year, tied down in the *quenouille* manner, is represented in Fig. 346. From the experience of French gardeners, it would appear that trees trained in the conical manner and *en quenouille* do not last longer than ten or twelve years. Copper wire is used for tying down the branches, and the lower ends of the wires are attached to the stouter branches, to the main stem, to hooked pegs stuck in the ground, or to a wooden frame fixed a few inches above its surface.

Fan Training. — The maiden plant is to be headed down to four eyes, placed in such a manner as to throw out two shoots on each side, as shown in the following figure. The following season, the two uppermost shoots

Fig. 347.



are to be headed down to three eyes, placed in such a manner as to throw out one leading shoot, and one shoot on each side; the two lowermost shoots are to be headed down to two eyes, so as to throw out one leading shoot, and one shoot on the uppermost side. We have now five leading shoots on each side, well placed, to form our future tree. Each of these shoots must be placed in the exact position in which it is to remain; and as it is these shoots which are to form the leading character of the future tree, none of them are to be shortened. The tree should by no means be suffered to bear any fruit this year. Each shoot must now be suffered to produce, besides the leading shoot at the extremity, two other shoots on the uppermost side, one near to the bottom, and one about midway up the stem; there must also be one shoot on the undermost side, placed about midway between the other two. All the other shoots must be pinched off in their infant state. From the third year it may be allowed to bear what crop of fruit the gardener thinks it able to carry; in determining which, he ought never to overrate the vigor of the tree. All of these shoots, except the leading ones, must be shortened at the proper season, but to what length must be left entirely to the judgment of the gardener, it, of course, depending upon the vigor of the tree. In shortening the shoot, care should be taken to cut back to a bud that will produce a shoot for the following year. Cut close to the bud, so that the wound may heal the following season. The following season, each shoot at the extremities of the leading branches should produce, besides the leading shoot, one on the upper and two on the under

part, more or less, according to the vigor of the tree ; whilst each of the secondary branches should produce, besides the leading shoot, one other, placed near to the bottom : for the grand art of pruning, in all systems to which this class of trees are subjected, consists in preserving a sufficient quantity of young wood at the bottom of the tree ; and on no account must the gardener cut clean away any shoots so placed, without well considering if they will be wanted, not only for the present but for the future good appearance of the tree. The quantity of young wood annually laid in must depend upon the vigor of the tree. But if any of the leading shoots manifest a disposition to outstrip the others, a larger portion of young wood must be laid in, and a greater quantity of fruit than usual suffered to ripen on the over-vigorous branch ; at the same time, a smaller quantity of fruit than usual must be left to ripen on the weaker branch. This will tend to restore the equilibrium better than any other method. The following figure is that

Fig. 348.



of a tree in a more advanced state, well balanced, and well calculated for an equal distribution of sap all over its surface. Whenever any of the lower shoots have advanced so far as to incommode the others, they should be cut back to a yearling shoot ; this will give them room, and keep the lower part of the tree in order. In nailing, care must be taken not to bruise any part of the shoot ; the wounds made by the knife heal quickly, but a bruise often proves incurable. In nailing in the young shoots, dispose them as straight and as regular as possible. Whatever system of training is pursued, the leading branches should be laid in in the exact position they are to remain ; for wherever a large branch is brought down to fill the lower part of the wall, the free ascent of the sap is obstructed by the extension of the upper and contraction of the lower parts of the branch. It is thus robbed of part

of its former vigor, whilst it seldom fails to throw out immediately behind the part most bent one or more vigorous shoots.

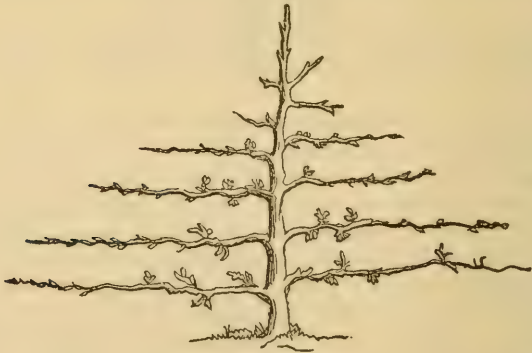
Horizontal Training.—This is practised either with one or two stems, and either with the upright stem straight or in a zigzag direction, to stimulate the lateral buds to develop themselves. From this upright stem, the branches proceed at right angles,—generally at nine inches apart for apples, cherries, and plums, and from ten inches to a foot, or eighteen inches, for pears. A maiden plant with three shoots having been procured, the two side ones are laid in horizontally, and the centre one upright, as in Fig. 349, which shows the first stage of horizontal training. All the buds being

Fig. 349.



rubbed off the latter but three, viz., one next the top for a vertical leader, and one on each side, as near the top as possible, for horizontal branches. In the course of the first summer after planting, the shoots may be allowed to grow without being stopped. In the autumn of the first year, the two laterals produced are nailed in, and also the shoots produced from the extremities of the lower laterals, the centre shoot being headed down as before. But in the second summer, when the main shoot has attained the length of

Fig. 350.



ten inches, or twelve inches, it may be stopped; which, if the plant is in proper vigor, will cause it to throw out two horizontal branches, in addition

to those which were thrown out from the wood of the preceding year. The tree will be now in its second summer, and will have four horizontal branches on each side of the upright stem ; and, by persevering in this system, four horizontal branches will be produced in each year, till the tree reaches the top of the wall, when the upright stem must terminate in two horizontal branches. In the following autumn the tree will have the appearance of Fig. 350, supposing an apple-tree be the plant to be trained, and that it consists of a single shoot from a bud. Let it be planted early in autumn, and next spring head it down to seven buds. Every bud pushing two or three shoots, the third and fourth, counting upwards, must be rubbed off when they are three inches in length ; the uppermost shoot must be trained straight up the wall, for a leading stem, and the remaining four horizontally along the wall. The leading shoot having attained about fifteen inches in length, cut it down to eleven inches. From the shoots that will thus be produced, select three, one to be trained as a leader, and two as side branches. Proceeding in this way for seven years, the tree will have reached the top of a wall twelve feet high. With weak trees, or trees in very cold, late situations, this practice will not be advisable, as the wood produced from the summer shoots would be too weak, or would not ripen ; but in all ordinary situations the plan will succeed.

Perpendicular Training. — This is comparatively little used, excepting for climbing shrubs, such as roses, the vine, and the gooseberry and currant, when trained against a wall or espalier rail. The principle is to have two horizontal main stems on the lowest part of the wall or trellis, and to train from these upright shoots at regular distances. Sometimes four horizontal main stems are used, — two at the bottom, and the other two half way up the wall or espalier ; but this mode is chiefly pursued with the vine.

Comparative View of the Different Modes of Training. — Of the various modes of training explained in the foregoing pages, any modification may be adopted when circumstances may require, provided the general principles are kept in view. Ornamental shrubs are easily managed, because they have not a tendency to rear themselves by forming a strong stem ; but with regard to fruit-trees the case is otherwise. These, it is well known, if left to nature, form one strong stem, supporting a top which reaches the height of twenty, thirty, or forty feet, or more. In order to attain this, the sap rushes, whilst the tree is young and vigorous, towards the leading shoot ; and if lateral branches occasionally are produced, the flow of sap is not strongly directed towards them, compared to that which is impelled towards the more upright part. At length, however, a ramification does take place, in comparison with which the leading shoot becomes less and less predominant, till it becomes ultimately lost among its com-

peers. A tolerably equal distribution of sap then results, and a conical or spherical top is formed, bearing fruit, not generally in the concavity, where it would be greatly excluded from light, but at the external surface, where the fruit itself, and the leaves immediately connected with the buds producing it, can be fully exposed to light, air, and dews. Lateral branches are occasionally produced on the stem, in the progress of its ascent. When the top is formed, these are placed at great disadvantage, owing to their being overshadowed; and they are then apt to decay, the tree assuming the character of a large, elevated top, supported on a strong, naked stem. This is the natural disposition of trees, and to this it is necessary to attend, in order that it may be counteracted where the natural form of the tree cannot be admitted. It should be borne in mind that the disposition to form an elevated naked stem is still strongly evinced in dwarf trees; although subdivided, yet each branch possesses its share of the original disposition, and its lower and horizontal shoots are left to become weak, in comparison with the upper, and those that are vertical.

CHAPTER XIII.

THE GREAT DISEASES OF PLANTS.

BLIGHT, OR BLAST — CANKER, OR CRIES — CONSUMPTION — CONTORTION —
DROPSY — ERGOT — HONEY-DEW — CURL — MILDEW — POTATO ROT — SMUT —
COTTON ROT — COTTON RUST — COTTON BLIGHT — SORE-SHIN.

BLIGHT, OR BLAST.

Description. — Blight is any disease which seriously damages or prevents the fructification of a crop. Some of the most familiar and devastating kinds of it have been fully investigated, and are known to be caused by insects, by fungi, or by well-defined chemical or meteorological agencies; and have been described with an accuracy and minuteness which enable us readily to distinguish them from one another, to designate them by distinctive names, — such as Mildew, Smut, Rust, &c., — and to point out their origin, their indications, and their prevention, alleviation, or cure. There are however, one or two kinds of blight still mentioned by writers under the name of blight, and which are either principally or wholly ascribable to meteorological influence; and these may here be noticed.

Different Kinds of Blight. — One kind of blight is occasioned by prematurely mild weather, followed by sharp frosts and easterly winds, in spring, which are liable to arrest the flow of sap from the roots, occasion the young leaves and shoots to shrivel and die, and cause the arrested juices to swell and burst the tender vessels, and to become the prey of innumerable aphides. The general result is either the death of the plant, the destruction of its growth for the season, or at least the infliction upon it of a great degree of temporary feebleness. The aphides which feed upon the extravasated juices, though but a consequence of the blight, are sometimes mistakingly regarded as the cause of it, and supposed to be wafted by the east wind. Unskilful gardeners sometimes aggravate the blight by closely matting up the trees, or keeping them protected during the day, thus rendering them so exceedingly tender that even a slight subsequent frost does them material damage. The sudden evaporation of hoar-frost from the opening leaflets of a young hedge, by a powerful sun, in a calm vernal atmosphere, sometimes so utterly destroys the incipient shoots, and kills all the young foliage, as to produce, in a few days, the appearance of a severe scorching by fire. A

hedge thus blighted occasionally remains leafless throughout the summer, or only shows some feeble symptoms of exfoliation toward the beginning of autumn; and it ought, in every case, to be left untouched till, by its own vitality, or without any artificial appliance, it has recovered strength and vigor.

Another kind of blight sometimes occurs in summer, when farm crops have attained their full growth, and is usually ascribed to sultry and pestilential vapor, — the plants being shrunk and shriveled up to less than half their former size, with a withered and blasted appearance. Though such instances as this are ascribed wholly to atmospherical causes, a careful inspection of the straw might possibly detect the presence of minute parasitic fungi.

A third kind of blight, called by many the white blight, is occasioned by deficiency or failure of proper nourishment. It occasionally attacks all kinds of plants, both wild and cultivated; is most common in thin, gravelly, irretentive soils, in very dry seasons; and it usually consists in throwing the plants prematurely into blossom, and ripening the ear or pod before the body, or more than the mere embryo of the seed, is formed. The only known palliatives or preventives of these three kinds of blight are, proper condition and thorough treatment of the soil.

CANKER, OR CARIES.

Description. — This is a disease in fruit-trees, elms, larches and other trees. It chiefly corrupts the juices, corrodes the substance, and destroys the vitality of the young shoots and branches of fruit-trees, and it has long been known and deplored as a most formidable enemy of orchards. Its symptoms vary considerably in trees of the same species, and very widely in trees of different genera. In some instances of its attack, a black speck appears on the epidermis of a tree, assumes the character of an erosion, and gradually eats away the organism, till the branch becomes utterly enfeebled, and readily breaks; in other instances, a scrofulous-looking ring surrounds the branch, and eats its way inward till it reaches the pith; and in others, a black and thread-like line of disease originates in the pith itself, and exerts, in the direction of the exterior, a killing power upon all the branch's functions. The first of these, however, is the most common commencing symptom of the disease, and this is usually accompanied with an enlargement of the vessels of the bark, but in some instances is dry, and in others watery.

The swelling or enlargement of the vessels of the bark, which constitutes so conspicuous a symptom of some of the ordinary kinds of canker, invariably and prominently attends it in the apple-tree, invariably but less prominently attends it in the pear-tree, frequently but not always attends it in the

elm and the oak, and very seldom, if ever, attends it in the peach. The swelling is soon communicated to the wood, which, if laid open to view, on its first appearance, by the removal of the bark, exhibits no marks of disease beyond the mere unnatural enlargement. In the course of a few years, — less in number, in proportion to the advanced age of the tree, and the unfavorable circumstances under which it is vegetating, — the swelling is greatly increased in size, and the alburnum has become extensively dead; the superincumbent bark cracks, rises in discolored scales, and decays even more rapidly than the wood beneath. If the canker is upon a moderately-sized branch, the decay soon completely encircles it, extending through the whole alburnum and bark. The circulation of the sap being thus entirely prevented, all the parts above the disease of necessity perish. The first appearance of the disease in the peach is so very slight, that an unexperienced observer of it would suppose it to be of no consequence. Small brown circular spots constitute the whole of this appearance, and may easily be cut out with the knife, so as to let the subsequent vegetation be as vigorous as if they had never existed. But let the spots be forgotten for a few days, and when the observer returns to examine them, they will be found to have spread far and corroded deeply.

Origin. — The causes assigned for canker have been very various and conflicting, and the subject of much controversy. Some writers think that it is occasioned by coldness and churlishness of climate; others regard it as a tropical disease in the parts immediately affected, brought on by some bruise or other injury, and exasperated by an unhealthy sap, consequent upon unfavorableness of situation, soil and culture; others view it as an effect of the lodgment of minute, parasitic fungi, growing from spores, either taken up from the soil through the spongioles, or received from diffusion through the atmosphere into cracks or wounds in the bark; and others think that it is a disease in the constitution or whole organic system of trees, — that it springs from a vitiated and peccant state of all the juices, and that it will again and again break out, independently of any external injury or agency, so long as the juices continue to be unaltered.

Opinions as to fungi being the cause of canker are exceedingly various and conflicting. Minute parasitic fungi unquestionably attend most instances of canker, and sometimes exist in such myriads as to impart a peculiar tinge to the whole stem of cankered trees; but very different fungi attack different trees, several kinds sometimes attack the same species, and possibly some are either causes or aggravations of canker, while most are merely innocuous effects. The *stramatosphæria multiceps* so commonly and greatly abounds on cankered pear-trees, particularly on the jargonelle, the Windsor, the swan's egg, the summer bergamot and the autumn bergamot

varieties, and seeming to make their young shoots, and even their older branches, die away toward the extremity, that it has been regarded by some close observers as the sole cause of their canker ; — a kind of fungus totally different from this accompanies, and has been thought by some persons to rouse, precisely similar symptoms of canker in apple-trees.

The opinion that canker is occasioned by the weakness of a tree's constitution, by a distemper in all its juices, or by a deficiency in its functional energies, and by a consequent inability to imbibe and elaborate sufficient nourishment for existing organs, and sufficient matter for the formation of new parts, — this opinion makes very ample allowance for the malign influence of bad climate, bad soil, bad cultivation, bad variety of tree, and all sorts of accidents and unfavorable circumstances ; and, as maintained by some writers, it even seems to speak of constitutional distemper as a convenient general expression for the operation of all kinds of conceivable causes. Johnson maintains that all facts unite in confirming the opinion that canker arises from the tree's weakness. It matters not whether its energy is broken down by an unnatural rapidity of growth, by a disproportioned excess of branches over the mass of roots, by old age, or by the disorganization of the roots in an ungenial soil ; they render the tree incapable of extracting sufficient nourishment from the soil, — consequently incapable of developing a sufficient foliage, and therefore unable to digest and elaborate even the scanty sap that is supplied to them.

Both soil and subsoil, in spite of the assertion of a few writers to the contrary, appear to exert a very considerable influence. A wet, retentive subsoil does not permit sufficient aeration, cannot perform sufficient digestion, and will not allow a sufficiency of perfectly fresh elements of healthy sap ; and therefore must act malignly, not alone as a reservoir of cankering vapors, but as an originator of impoverishing and poisonous juices. A deep and very rich soil gives trees a plethoric and dropsical habit, and, in consequence, occasions so powerful a predisposition to canker, that a cure for this disease in an orchard has sometimes been found in the simple process of wheeling away one stratum of the soil, and diluting the remaining stratum. If a subsoil either be ill-drained or consist of ferruginous gravel, or if a soil be clayey and not kept well drained and porous, all trees which grow upon it, but especially fruit-trees, are exceedingly liable to become cankered. A soil exhausted by long cropping, or charged with the sporidia of accumulated growths of minute emphytic fungi, is peculiarly unfavorable ; and hence an old worn-out orchard, if replanted with fruit-trees, is almost certain to communicate canker to even the most vigorous young plants which can be selected. A cold situation, frequency of raw fogs, and the prevalence of piercing and moist east winds, in the spring, seem to be the principal cankering elements in climate. Injudicious pruning, bruises,

damage to the bark, and all similar accidents, if they do not originate canker, seldom fail to aggravate it. Trees of every age are liable to canker; but, as a general rule, all become increasingly so as they advance in age, and particularly such as have had a vigorous growth in their youth. All grafting varieties of fruit-trees, also, become more and more cankerable as they multiply in reproduction, till they eventually acquire such an accumulation of peccant humor as to be continually diseased, and no longer propagable. The scions of an old variety of fruit-trees merely multiply an aged individual; and though they acquire temporary vigor from the young and stimulating sap of the stocks on which they are grafted, they become, in a few years, as cankerable and decrepit as the parent tree. The golden-pippin, one of the oldest varieties of the apple-tree at present cultivated, is frequently and severely attacked by the canker,—more so, according to some writers, than any other kind.

Remedy. — The prevention and cure of canker are necessarily various, and must, in any one instance, be directed against the special forms which the disease assumes, or the particular cause by which it is excited. If coldness of climate be the only cause which can fairly be assigned for it in any particular orchard, covering with glass is the chief preventative; and this, of course, can be applied to only a few select wall-trees. If fungi can, in any instance, be regarded as a chief exciting cause, a proper remedy might probably be the free use of the knife, and a subsequent copious washing with caustic lime-water. If plethoric or dropsical habits seem to be forming, or have already formed, one of the main roots of the tree may be removed, and an admixture of poor loam, sandy mould, or even of drift sand, or any other diluting matter, may be worked into the soil. If mere weakness of constitution, or defect of functional energy, appears to be the cause, while no one kind of exciting influence can be detected or inferred, a very efficient remedy is, to cut away all the infected parts, and make a judicious pruning among the remaining branches; and even if such exciting circumstances as unfavorable climate, ungenial soil, or previous bad culture, can be detected, an excellent effect may be produced by the gradual sawing and cutting away of exuberant branches and shoots. If canker in a fruit-tree is a consequence of old age, it is probably a premature senility, induced by injudicious management. Unless in the last stage of decay, a tree may be recovered by giving it more air and light, by carefully heading-in, pruning, improving the soil, and cleansing the bark. If the soil, by its ungenial character, induces the disease, the obvious and only remedy is its amelioration; and if the subsoil is the cause of the mischief, the roots must be prevented striking into it. In all cases, it is the best practice to remove the tap-root. Some persons recommend, and many successfully practise, the

removal of all decayed or exuviated bark, and the application of various liquid washes, such as a solution of common salt, or a diluted liquid compound of cow-dung, soap-suds, and urine. When any bruise or other injury is inflicted, of a kind likely to induce or develop canker, a piece of living bark from another tree might be exactly fitted into the incision, in the same manner as in the operation of budding. The grand preventative of canker in larch-trees, — which are frequently and severely the subjects of this disease, — is to select, for plantations, such situations and soils as shall not subject the trees to combined coldness and moisture.

CONSUMPTION.

This is the gradual enfeeblement and eventual wasting away and death of a plant. This must be viewed less as any one disease than as the common or aggregate character of a number of diseases. It originates variously, in too frequent and profuse flowering, in bad planting, in mechanical damage to the roots, in poverty of soil, in excessive drought, in severe and sudden vicissitudes of weather, in unusually tempestuous winds, and probably in some other causes equally distinct; and it may be supposed to have a variety in its modes of action, or in its distinctive characters, corresponding to the variety of these causes. The preventative of most kinds of it is manifestly good culture.

CONTORTION.

This is the effect of the injury inflicted on the leaves of plants by the puncture of insects, particularly of the aphides. The leaves of the peach, the apricot, the nectarine, and the apple-tree, are very liable to contortion. The only sure preventative of the evil is to destroy the little creatures which cause it.

DROPSY.

Dropsy is a watery and diseased swelling in some parts of plants. It occurs chiefly in plants of a succulent nature, and principally in bulbs, tubers, and fruits. It appears to arise from the absorption of more moisture by the spongioles than can be secreted in the plant or thrown off by the leaves; and it is known to be caused by excessive manuring, excessive artificial watering, and an unusual abundance of rain. Bulbs and roots affected with it are watery and swelled; fruits are watery and insipid, and fall before being ripe; and leaves, though continuing green and apparently sound, suddenly and prematurely fall.

ERGOT.

This is a disease in the growing grain or seed of some of the grasses, particularly of rye. It is the most mysterious of all the diseases with which

the cereal grasses are affected; and, after multitudinous and most learned investigations, continues to be the subject of conflicting opinions as to its nature, its origin, and its mode of development. The substance called the ergot either issues from between the glumes, and occupies the place of the grain, or it is the grain itself, in both a monstrous form and a chemically altered condition. It lengthens to more than double the natural size of the grain; protrudes beyond the chaff; is angled, grooved, and furrowed; has a deep, purplish-brown color, and often assumes a curved form, somewhat resembling that of a cock's spur. Its surface, when seen through a microscope, is profusely marked with white, shining, transparent, angular dots; and its interior, when laid open with a sharp instrument, and seen in water under a microscope, appears to consist of white flocculent threads, with spherical sporules. It has a spongy texture, a heavy, disagreeable odor, and a nauseous, acrid, burning taste; and when put in contact with the flame of a candle, it catches fire like an oily substance, and burns like an almond. It is supposed by some naturalists to be an excrescence similar to the oak-apple and the nut-gall, and to be occasioned by the puncture of some insect; by others, to be a monstrous development or morbid swelling of the seed, occasioned by some disturbance in the organs of circulation or secretion; and by others, to be a foreign or super-imposed vegetable growth, occasioned by a parasitic fungus. The last of these opinions is probably the best supported.

Whatever be its origin and its physical nature, ergot exerts a dreadfully noxious power upon the system of any men or brutes who receive even very small portions of it in their food. It has been ascertained, by experiment upon many of the lower animals, to produce the most horrible gangrenes, rotting of the extremities, internal tortures, and agonizing death; it has been known to slough and kill not a few human beings who have eaten grain or flour infected with it.

HONEY-DEW.

Honey-dew, so called, is a clear, colorless, viscid, sweet liquid, found often on the leaves of plants, and sometimes on the ground beneath them. It tastes somewhat like honey; it is perfectly fluid in warm weather, but is somewhat consolidated or candied in cold weather; and, when evaporated from paper, it leaves a gummy mark, not unlike that left by solution of gum-Arabic. It appears sometimes in blotches upon leaves; sometimes in suffusion over the whole surface of the lower leaves; sometimes in globular drops, of various sizes; but, in all ordinary instances, it appears merely upon leaves, and only in such quantity as to seem like exudations on their surface. All ants and wasps and bees are extremely fond of it.

The opinions of different writers are very conflicting as to the origin, and so forth, of honey-dew. The most intelligent supposition respecting it is, that it is entirely the deposit of minute insects,—small flies, perhaps a species of the genus thrips,—which emit a sweet clammy liquor on the leaves of the tree it lives on. This opinion is fortified by the fact of there having frequently been noticed a great concourse of thrips, as well as aphides, on trees infested with honey-dew. The aphides, however, are by many persons considered the chief or sole producers of it, and it accompanies their flights and colonizations. They differ very widely, in some principal parts of their economy, from all other animals; and cannot be regarded with greater wonder as ejectors of a viscid saccharine liquid, than as propagators of their species through a series of progenies as the effect of a single impregnation. They live wholly on liquid food, and discharge no solid excrements, and are provided not only with an anal vent, but with two long, horn-like rump tubes, for ejecting such refuse or portion of their food as is unnecessary for their nourishment. If they were regarded as forming the saccharine matter of the honey-dew in their interior organism, they would no doubt be a notable exception to the otherwise uniform origin of all saccharine substances; but, when their peculiar economy of feeding and structure is considered, they may easily be supposed to act as simple living ducts of the saccharine matter from the vegetable vesicles in which they find it to the surface of the leaves on which they deposit it; or, in other words, they receive the saccharine matter ready made in their liquid food, and simply part with undecomposed portions of it in their ejections. The particular species which deposit most honey-dew are *Aphis brassicae*, *Aphis ropæ*, *Aphis ubui*, *Eriosoma populi*, and *Eriosoma mali*.

Honey-dew possesses an incidental value as an occasional and sometimes a principal food for bees. But, on the whole, honey-dew is a serious evil, partly by disfiguring the foliage of fruit-trees, and stickily attracting dust to plums and cherries, but chiefly by arising, through the medium of the aphides, from an enormous abstraction of the healthy juices out of plants. The only effectual preventive or cure of it, of course, is to ward off or destroy the aphides; and some of the chief means of dealing with the species are noticed in our chapter on INSECTS. But a weak solution of common salt, applied to the soil around infected trees, has been found to be effectual.

CURL.

This is a disease in potato plants. It is developed before the plants rise to the surface of the ground, and it affects them through all the future stages of their existence. The stem of the infected plants is puny and stunted; the

leaves are meagre, sickly and crumpled ; and the tubers are small, and, if used for sets, are certain to propagate the disease. Of the various causes of this disease assigned by different writers, the true one appears to be the diminution of the vital energy of the tubers, either by over-ripening, by bad keeping, by sprouting, or by too deep planting. The want of strength to develop a full, healthy plant, is the disease itself in embryo ; and this is occasioned by any circumstance which diminishes the store of nourishment contained in the tubers for the support of the young plants.

The means of preventing curl are distinctly suggested by the nature of its cause ; and some of these means will, at the same time, prevent other diseases of the potato, and promote the general health and vigor of the plants. Tubers intended for sets ought to be simply matured and not over-ripened ; they ought to be kept, throughout the winter and till the time when they are wanted, in a condition of dryness, coolness, and exclusion from light and air ; and if, through mismanagement or accident, they be allowed to shoot, or even to exhibit decided symptoms of begun vegetation, they ought to be rejected from the uses of planting. The sets ought to be immediately planted after they are cut, and ought to be kept from exposure, during even the briefest time, to the play of sunshine, to a very high temperature, or to the current of a drying wind. The manure ought to be regularly spread and mixed with the soil, and not laid along a trench, or put in immediate contact with the sets. Potatoes ought not to be planted, for a succession of years, on the same field or plot ; and the tubers used for planting ought, every year, or as frequently as possible, to be obtained from another kind of soil, particularly from a poorer one than that in which they are to be planted. When the seed-stock is carefully pitted, and not exposed to the air, in the spring, the crop has seldom any curl ; but where the seed-stock is put into barns, and other similar places, for months together, such crop seldom escapes turning out in some measure curled ; and if but few curl the first year, if they are planted again, it is more than probable the half of them will curl the next season.

MILDEW.

The Use of the Word or Term.—This is the appropriate name of a specific, devastating, and dismally common disease in wheat and other grasses, and is now the only thing meant by the word mildew, in the writings of the most intelligent and scientific agricultural writers.

Its Nature.—With respect to its nature, all botanists now believe that mildew, in its normal form, as a spotting and blotching on the stalks of wheat, is the regular parasitic growth of minute fungi, — *Puccinia graminis* ; and several of the most eminent writers think that the diseases called

rust, red-bag, red-robin, and red-gum, which infest the leaves and chaff-scales of wheat, and produce a discoloration similar to that of iron-rust or of burning, are simply modifications of varieties of the normal mildew, or *Puccinia graminis*.

Growth and Phenomena of Mildew. — Though one of the minutest objects in the vegetable world, mildew is so prodigiously prolific and immensely multitudinous as to be one of the mightiest physical scourges, as well as one of the oldest; and yet, even at this advanced period, it hardly begins to be properly understood. The name *Puccinia* is formed from a Greek word, which signifies “closely,” or “thickly,” and alludes to the crowded manner in which the minute fungi are packed in the tufts and patches in which they grow. A stalk of wheat, when beginning to be mildewed, exhibits a number of dark-colored spots beneath the epidermis, some of an orange hue and others of a dark-brown tinge; and, in a short time, it suffers ruptures and openings of the outer cuticle, and displays, in protrusion through these, dark, musty clusters of spores, anastomosing in dense, diffuse tufts, and often confluent into one another, so as to constitute long parallel lines, and commonly possessing at first a brownish-yellow color, and changing afterwards to black. Any intelligent person, with the aid of a proper microscope, and of a good brilliant light, may easily show to the farmer the forms and appearances of mildew. First strip off a little bit of the affected straw, and let it be viewed as an opaque object. The thick clustering of the spores might be easily pointed out, as well as the way in which they rupture the cuticle, — a half-inch achromatic object-glass, with a low eye-piece, will suffice for this; with a higher power, and bits of cuticle and straw cut so thin that the light may easily be shown through them from the mirror, the stomata would be seen, and the vegetation of the spores on the mycætium in the cavities beneath them. Lastly, a small piece of one of the dark patches might be taken off with the point of a pin, or of a small penknife, and laid on a strip of glass. Moisten this with a little drop of water, and cover it with a small fragment of the very thin glass sold by opticians for such purposes. Place it on the stage of the microscope, show the light through it, and look at it with a quarter of an inch achromatic. The structure of the spores, the division of the chambers, the stalks, and every part of them, will become distinctly seen.

The *Puccinia graminis* affects, not wheat only, but other cereal grasses, and even several species of reeds; and it is common to almost all countries in the world. A growth of it, when seen unmagnified upon the leaves of other plants, presents nearly the same appearance as on wheat, and may instantly be detected by an observer of it upon the latter. It may often be detected in the lower part of the stalk of wheat, — generally on the shoot-blade,

as early as the second week of June ; but it never makes any very serious appearance, nor even affords decided indication of being about to make any considerable devastation, till some time in July. If the weather in July be hot and dry, even though the fungus may have recently devastated the district, it will seldom make an extensive or very hurtful development ; but if the weather in July be close, moist, and cloudy, even though the fungus may have been recently scarce in the district, it will possibly make a great, and somewhat sudden, and very menacing appearance. The farmer, in the latter case, ought diligently to examine his wheat crop, especially such as seems to be strongest and most luxuriant ; and if he detects any considerable number of tufts of the fungus upon the stalks, he ought promptly to bring into play such methods of treatment as have been found most effectual for subduing mildew.

When the sporules of puccinia have entered the stomata of wheat, and effected a lodgment beneath the epidermis, and begun to vegetate within the stalk, they both prey upon the tissues and intercept a portion of the sap which ascends from the spongioles of the roots for the forming and nourishing of the grain. But the exterior portion or sheath of the grain is generally formed before any considerable mildewing occurs ; and the period of the formation and growth of the inner portion, or farinaceous substance, or flour, is precisely the period of the most general and vigorous development of the sporules into spores and full-grown fungi ; so that, usually in the proportion of the number of the fungi which infest a stalk, the grain becomes shriveled while growing, and contains comparatively much bran and little flour when reaped and threshed. The sample of a seriously mildewed crop of wheat, in every instance, looks poor to the eye, is deficient in flour, and contains a superabundance of bran.

The *Uredo linearis* and *Uredo rubigo*, though believed to be mere varieties of *Puccinia graminis*, and though sometimes assuming appearances closely akin to those which are popularly called mildew, generally have different habits, and follow somewhat different laws, and take from the popular vocabulary of farmers the names of rust, red-rust, red-robin, red-rag, and red-gum. The *U. linearis* takes its name from the oblong form of its spores ; and the *U. rubigo* takes its name from its reddish-rusty color, and has nearly spherical spores. Both vary in color from an orange tint to a brownish hue, and make the parts of plants infested with them to appear as if dusted with an orange or a brownish rustiness. They occur on the old or young leaves of the plants, on the chaff-scales, and on the stalks ; and they infest the plants at all stages of their growth, and may be regarded as occurring principally on the young blades in spring, principally on the stalks when developed about the same time as the *Puccinia graminis*, or in mixture with

it, and principally on the old leaves and on the glumes and paleæ in autumn. Their presence in the chaff-scales is indicated by rows and clusters of somewhat ovular minute spots; and the matter composing them exudes from the inner surface like a reddish gummy substance. A very destructive fungus attacks the common cabbage, and appears upon it as a mildew. It appears upon cabbage-leaves, in clusters resembling small white patches, or specks, or frosty incrustations. All the spores are filled with sporules, and burst when they are ripe, scattering them in every direction; and whenever these find their way to the leaves of cabbages, they take root upon them, and propagate.

Provocatives, Preventives, and Correctives. — The extermination of *Puccinia graminis*, *Uredo linearis*, and *Uredo rubigo*, from any district or country, seems to be impossible. But the mildew can manifestly be very greatly controlled, and, in an aggregate of years upon any farm, may be exceedingly diminished. The conditions of soil, of crop, of culture, and even of climate, which predispose to it, by either rendering it prolific, or giving high vivacity to its sporules, or producing an aptitude in the stomata of plants to imbibe them, or disposing the tissues and juices of the plant to foster and develop them, may be very powerfully modified by the skill and the arts of enlightened husbandry. A generally healthy state of the plant, without any over-luxuriance of vegetation, is most likely to secure a crop against the attacks of the rust and mildew fungi; but whatever tends to render the plant sickly, — whether it be excess of heat or cold, drought or wet, sudden changes of temperature, poverty of soil, over-manuring, shade, &c., &c., — must be considered as a predisposing cause to these diseases. Wherever the farming is of the best kind, and where drainage is good, the mildew fungus will not be found in any alarming degree.

The mildew fungi multiply and flourish most in a moist atmosphere, in a subdued light, and in a gentle warmth; and are therefore most abundant and destructive in climates and situations which are subject to what farmers expressively call “muggy weather.” This may appear, at first sight, to be a cause of mildew entirely beyond the control of farmers. Yet something may be done to escape it, by practising such methods of culture, and adopting such times of sowing, and using such varieties of seed-stock, as are best fitted to bring the crop into a state of the utmost possible maturity and vigor at the particular season when the moistness or mugginess is, on the average of years, most prevalent. Foggy weather, in some circumstances, seems to be even a stronger provocative to mildew than ordinary moist weather; and, when preceded by a time of great drought, occasions an unusually great mildewing of wheat crops.

All soils are very seriously subject to mildew, yet some yield more readily

and abundantly to it than others. Tenacious clays seem to offer it the greatest resistance, and light moorish or light limy soils seem to offer it but slightly. The soils most liable to have their crops injured, particularly that of wheat, are the following, and in the order stated:—peat or moor, limy, limy loams, sand, sandy loams, and another kind not found in any great breadth, but in patches, chiefly, but not exclusively, in clayey soils,—the practical farmer calls it gray earth. Whatever has a tendency to check a quick and great loss of heat in the substances which surround vegetables, particularly their roots, will be best calculated to save them from the injury inflicted by sudden vicissitudes of temperature; consequently, those earths which are the worst conductors of heat, or, in other words, are the longest in heating or cooling, will be the most favorable in resisting any sudden alteration, and the vegetable growing on them will be the least injured when so assailed. The improvement of light soils by abundant intermixtures of clay, therefore,—in addition to the great advantages of better texture and richer supply of inorganic food,—involves the benefit of appreciably and permanently diminishing liability to mildew.

All varieties of wheat are seriously liable to mildew, but some are rather more liable than others. The white is generally the earliest affected, and the bearded or rivet is generally the latest. Any variety of wheat which has a comparatively soft epidermis is probably more subject to mildew than one with a comparatively hard epidermis.

The time of sowing, regarded correlatively to the time of its maturing and to the principal time of mildewing, is important. Early-sown wheat-plants are more likely than late-sown ones to pass the time of blooming before being extensively attacked; and when they can begin to form their seeds before the mildew sets in, they suffer far less damage from it, or are far less embarrassed and impoverished during the process of seeding, than if they were attacked in an earlier stage of their growth. Late-sown plants, too, are green and sappy at the very season when the chills and fogs and courses of moist weather, which specially induce mildew, are most abundant; and they are, therefore, liable to be both vigorously and very extensively attacked. Yet, in some cases, early-sown crops, almost or quite as much as late-sown ones, are preyed upon by mildew.

Rank or excessive manuring, or any combination of circumstances which occasions excessive luxuriance in a corn crop, both invites mildew, and greatly invigorates and spreads it. The application of farm-yard manure immediately before sowing may both make such an evolution of gases as to attract the sporules floating in the atmosphere, and promote such a temporary plethoric growth in the crop as is eminently suited to the lodgment of the sporules and the development of the fungi. Excessive early luxuriance,

whether from immediate manuring, from over-richness of the soil, or from unusual forwardness and warmth in the weather, ought to be checked by feeding down with sheep during a few hours in the day-time, or by any other method which experience and local peculiarities may suggest.

A clean or a foul state of the ground, during the early stages of the growth of a crop, has, in all cases, a great influence upon eventual mildewing; weeds serve as nests of the mildew fungi, and nurse, and feed, and multiply them, preparatory to extensive and severe attacks upon the corn; and, in all the early stages of the growth of drilled wheat, they ought to be completely kept down, and all the surface stratum of the soil, at the same time, kept in a perfectly sweet and well aerated condition, by the free use of the hoe. Mildew will seldom prevail to any extent where this precaution is taken; but wherever there are many weeds on the land, the straw will be generally found more or less affected by it.

Many methods have been recommended to prevent or destroy mildew; but almost all of them are impracticable or worthless. A solution of common salt, however, when applied, not to the soil, but to the crop itself, in the manner of either a vapor or a sprinkle bath, seems to kill the mildew fungus, and to operate, if not as a preventive against an attack of mildew, at least as a cure of actual mildew disease. The wheat on the seaside is little damaged by the mildew; yet, within a very few miles inland, the crops are as much affected as those still further from the sea. The safest quantity of salt per gallon is eight ounces, and then the application may be rendered more effectual by frequent repetition, without any danger of injury to the plants. If the application is not made during a clouded day, it is best to defer it till the evening.

As to the idea that the *barberry* has a considerable influence in the communication of the mildew to wheat, the conclusion arrived at by those who have investigated the matter, and whose judgment is entitled to respect, is, that no such influence is exerted or produced by that plant.

POTATO ROT.

Description. — The murrain, or rot, or mildew, or whatever else the modern potato disease may be called, exhibits a great diversity of phenomena, and probably comprises many and wide sub-varieties of character. Its great features are commencement after the formation, or even towards the ripening, of the tubers, and total, irretrievable, putrefactive-looking decay of the whole plant. It is said by some persons to begin in the leaf, — by others, in the stem, — and by others, in the tubers; it sometimes slowly works the plant to decay through a period of five or six weeks, and sometimes scathingly and scorchingly overwhelms it in the course of twenty-four hours, or in a

single night ; and, in not a few instances in which it seemed to have kept aloof from plants till they were harvested, it has burst out among the tubers and rotted them in the pit. No descriptions of it, for the present race of cultivators, are needed ; and the very best descriptions of it which have been penned are tinged with theory, and controlled by its own diversities, and are therefore very conflicting ; yet two brief notices of it, by two of the most distinguished observers, may be here recorded. That eminent European agriculturist, Mr. George Phillips, gives it as his opinion that the stem is the part where it commences. He also says :—The first external appearance of disease was marked by a deepening of color, accompanied by an enlargement of the affected part, and succeeded by a weeping or exudation. As the disease advanced, the part of the stem affected became soft and pulpy, and the color changed to a yellowish-brown. The stem was generally, if not universally, first affected at a joint, or the part from whence a lateral branch springs, and the leaves above the diseased part blackened, drooped, and died. Seven plants (says Mr. Phillips) were forwarded to me by a gentleman of great practical knowledge, and better specimens for the purpose could not be desired. The stems were all connected with the parent sets, so that the foliage, stems, young tubers, roots, and sets, were complete. The upper part of the stems and leaves of the diseased plants had the dull and heavy appearance so characteristic of the disease ; and nearly the whole of the stems were more or less affected at one or the other joints whence the lateral branches sprang from. In some of the plants the stem was most affected at a particular joint ; in others, the smallest branches and leaves were the most injured. No trace of fungi or insects was discoverable in some of the affected stems beyond the immediate localities of the diseased joints. The disease in these cases had not extended itself, and was confined to a space not exceeding one inch of the length of the foot-stalk. In other cases, the disease had spread both ways for a considerable distance from the wound, confining itself chiefly to the medulla. Fungi of the boleti and stellate kind were observable in all the diseased stems ; and at the parts where putrescence existed, the eel-like animalcula abounded. According to another learned observer, the disease usually commences in a semi-transparent blotch on the underground parts, which is formed by brown, shiny, extravasated fluid between the epidermis and inner bark, sometimes only on one side of the stem or roots ; and, if the soil becomes dry and the weather fair, it penetrates through the bark rather slowly, but progresses rapidly in a damp soil, with a close, humid atmosphere. Several of these blotches, in their transparent state, were marked, as soon as found, with bits of thread, and it was seen that, sooner or later, according to the circumstances above mentioned, they assumed a scurvy, opaque appearance outside ; but, by cut-

ting through this, the shiny fluid might generally be seen within. The blotches in the tubers change in a similar manner, and the progress of the gangrene in them is accelerated or retarded by the like circumstances. Similar blotches appear about the same time, or soon after, on the roots and cords. Sometimes, however, the leaves are blotched first of all. Many very large plants have been found with nearly every leaf and the stalks likewise blotched, the leaves being covered with botrytis, while the roots and lower parts of the stems remained quite clear; but (says the same writer), I have never seen, until the 24th of October, diseased roots or cankered stems supporting healthy foliage. Hence it appears that the disease does not uniformly originate in the underground parts, but that the plant is stricken throughout its system by an ungenial, or, rather, by a pernicious state of the atmosphere, — the effects of which, as amongst animals, break out sometimes in one part and sometimes in another. As to the diseased tubers, at whatever time they were first affected, whether in the field or in the pit, many of them soon became rotten to the core; others rotted in patches, and acquired an appearance similar to that of an apple bruised by a fall; and a few, after being dried and carefully stored, ceased to be further injured. The diseased parts, in an advanced stage, commonly formed irregular ulcers, and emitted an offensive odor; the parts around the eyes, in many instances, became mouldy; and the part next the stem, in general, was the soonest and most severely affected. The tainted tubers were largely employed for the feeding of cattle and hogs, and are not reported to have done any injury to their health; and, when boiled, their tainted portion, in its earliest stage, was sweet-tasted, and had a disagreeable smell.

A report, in the Highland Society's Transactions, of special communications from intelligent farmers in most of the affected districts of Scotland, in 1845, affords the following observations: — The disease appeared chiefly in the latter part of August, and in September and October, yet broke out in some places in July, and did not break out in others till the tubers were lifted and stored; the weather was prevailingly cold and ungenial, but no precise state of it could be identified with the breaking out of the disease; early varieties, which were matured soon in the season, either escaped the disease, or were much less affected by it than the later varieties; all varieties whatever, except the earliest ones, were more or less attacked, but in different degrees, and the varieties which escaped best were the Second Early, the Irish Cup, the American Early, and the Common Cup; potatoes raised recently from seeds, in the great majority of cases, were as subject to the disease as those which had long been propagated from the tubers, and, in many cases, were even more subject to it, though this fact militates noth-

ing against the desirableness or necessity of raising new varieties from seed, but only shows that they must be raised with skill and caution, and under all the conditions which are essential to real reinvigoration; the extent and progress of the disease were but little influenced by either the previous culture, the nature of the soil, or the kind of manure; the disease did not appear, at all events, to propagate itself by contagion, or to extend from diseased to sound tubers after they were taken from the ground; the most effective store-heaps were found to be small or moderately-sized ones, not too heavily loaded with earth; and mixtures of lime, or of other substances, with the potatoes in the heaps, were not found to be more beneficial than the old practice of storing the potatoes alone, dry, and in good condition.

Causes. — Many predisposing causes of the disease, both old and new, near and remote, have been assigned by theorists. Among the old ones are all the most remarkable which were ever at any time assigned for taint and curl, particularly degeneracy, over ripeness, bad storing, bad conditions of planting, high manuring, atmospheric influence, and epidemic miasmata; and some of these have also been regarded as special causes, or as immediately producing the virus, and defining the character of the disease. The chief of the newly-alleged predisposing causes were the wetness of the summer of 1844, the severe frost of March 1845, the great heat of the fore part of the summer of 1845, the uncommon luxuriance of the crop, the use of some special manures, and a fancied novelty in the condition of the earth, or subterranean heat of the soil and sub-strata. But while some of the alleged predisposing causes were real enough, perhaps, and ought to suggest to all cultivators the necessity of care and wisdom in all time to come, others are either doubtful, vague, or wildly fantastical, and no two or more of them can at all account for the origination of the disease, or point to any specific or very promising remedy. The special causes assigned by various theorists, including many of the most distinguished agriculturists, and phytologists, and organic chemists, in the world, are as numerous, as conflicting, and, we might add, as aggregately uninformative, as the alleged predisposing causes. We will, however, give a brief statement of those which are most remarkable for either their plausibleness, their learning, or the degree of public attention which they have excited.

The abnormal chemical condition of the potato-plant, or the too early arrival of it to chemical maturity, is modestly and suggestingly stated by Mr. Fromberg as the most probable special cause. According to his views, every species of plant appears to require a certain definite proportion of substances in its organism, to make it operate regularly for its healthy growth. Too great a deviation, exceeding a certain maximum or minimum, will have an injurious influence upon the growth, by either accelerating or

retarding it in too great a degree. As soon as, in a plant, both the parts that live in the air and those placed in the soil have obtained their proper quantity of constituents, the growth is completed. After that, it will take up nothing, or little more; and being continually placed in the midst of substances that are always in a state of decomposition, — which was before a requisition for the growth of the plant, — this state will, after the growth is completed, communicate itself to the plant and its constituents. This will be the case, even although the plant be perfectly sound (and we do well, therefore, to remove a product from the plant when ripe and full-grown), but much more rapidly when it is in a state of ill health. Both the want of activity of the cells and their contents when the growth is too languid, and their too great activity when the growth is too quick and strong, will predispose the plant to this chemical change. The altered energy of the action of the matter of which it is composed will continue after the growth has ceased, but now it will proceed in another direction; all the peculiar properties and combinations of matter which present themselves during lifetime, and on whose existence the vital actions depend, being now obtained and produced, another series of properties exhibit themselves, and a number of other combinations is formed. If the growth has been too languid, these combinations, necessary for the performance of the vital functions, will not be produced in sufficient quantity, and the altered activity of matter will commence before the growth is completed. In case the growth were too rapid and strong, the same increased activity of matter will combine after the plant has reached its maximum of growth, but will now, of necessity, take another course; the plant absorbing nothing more, and, consequently, vital action resting, decomposition sets in, and the degree of its action is entirely dependent upon the activity of matter, which again is determined by the quantity of substances fit for undergoing decomposition in a certain space, and upon the coöperation of temperature, air, and humidity. It might be of some importance to view, in connection with this, the early appearance of the disease in 1846, although it seems uncertain whether the time of ripening or full growth had also arrived sooner. It is a fact that diseased potatoes sprout with remarkable rapidity, whilst the experiments of some chemists show that perfectly sound potatoes remain in the soil without any signs of sprouting being perceptible. This fact does not contradict the above-mentioned idea, and will actually tend to corroborate it, if it may be proved, by experience, that diseased tubers, although producing plants that remain healthy for a time, will, however, make them inherit, as it were, their own unnatural rapidity and luxuriance of growth, and the consequences attending these.

The oxidation of the debilitated tissues, the change of azotized matter in

the stems, and the liability of the incrusting matter to undergo decomposition, have been suggested by Dr. Playfair, the well known Dutch chemist, Mulder, and by others, as the most probable special causes. But the notion of oxidation by the agency of the air acting more freely upon the organic matter of the weakened cell-walls, does not certainly show a very great amount of physiological knowledge, which requires that the progress of the phenomena should be followed step by step, and which does not permit that the mentioning of final results, even if they were correct, should serve as an explanation. The theory of changes of azotized matter either has reference to absolute decomposition or putrefaction, — and then it is closely allied to the oxidation theory, and partakes fully of its objectionableness, — or it refers to the transmutation of one nitrogenous proximate principle into another, and, in that case, it is contradicted by the doctrines of the protein compounds. And as to the liability of the incrusting matter to undergo decomposition, this, if at all probable, does not afford much explanation, and could scarcely serve to suggest means for recovery; for the nature of the incrusting matter, and its relation to inorganic bases, are at present far too little known to found a theory on their pretended action.

Putrescence, resulting remotely from atmospheric action, and proximately from internal chemical derangement, is supposed by Mr. Phillips to have been the cause. This theory somewhat combines the preceding ones with the theory of a series of predisposing causes, and addresses itself very plausibly to the understanding; but it is by no means definite enough, and can scarcely, if at all, apply to the cases of sudden and overwhelming outbreak of the disease, and does not perceptibly lead to any very obvious practical conclusion. Mr. P. states, in illustration of his theory, that the season was unusually cold, and was marked by a continual absence of sunshine, — that the disease was more fatal on heavy wet lands than on light dry lands, and generally more so on wet soils than on dry soils, — that exhalation and evaporation were at a low point during the months of July and August, — that the plants generally throve till after the cold and wet weather set in, and did not indicate prevailing unhealthiness till after it had continued about two months, — and that, at the time when the most unfavorable weather appeared, the late plants were in full work, and were forming their tubers: and he adds, that a plant cannot elaborate its products without the direct action of the sun's rays; and when the vital principle ceases its action, even temporarily, a chemical one commences by an oxidation of the carbon and a liberation of carbonic acid, and if this action continue, ammonia is formed. What is the effect of this? If ammonia be formed in a plant like the potato, which in its normal state is acid, we have not only a subversion of the condition of the juices, but we have also an agent equal to effect all that we have seen in

the disease. But the change is a work of time in the plant, and necessarily involves many phases.

A species of botrytis, which had not been before observed, and which has been variously called *B. infestans*, *B. fallax* and *B. devastatrix*, was supposed, by Professor Morren, of Liege, and by many others, to be the special cause. Some supposed the fungus to develop itself from the interior or cellular tissue, and to extend its ramifications through the pores or stomata in such a way as to close them completely up, and to make the plant die from want of perspiration and absorption; others supposed it to make a lodgment by its sporules from without, to feed upon the plant in the manner of an external parasite, and to rob it to exhaustion of its nourishing sap; and others, without troubling themselves to explain either its habits, its nature, or the chemistry of its action, supposed it to do its deadly work simply as a poisoner of the plant's juices. When first observed, the fungus was said to thrive only on the living leaves of the potato-plant, sparing even the stems; but afterwards it was seen to attack both the stems and the tubers; and soon, and far and wide, it could not be traced at all in some diseased plants, and was not traceable in others till after the disease was obviously established. The theory of the fungus was by far the most popular one in 1845, and made the learned part of the agricultural world ring with talk about *Botrytis infestans*, but it was speedily discovered to be fallacious, and is now universally abandoned. Yet, though the botrytis was not the cause of the disease, it was generally a very close attendant on it; and, under peculiar conditions of the atmosphere, it undoubtedly acts as a very powerful agent in accelerating the decay and havoc which the disease begins.

A number of insects — particularly *Eupterix solani*, *Eupterix picta*, *Thrips minutissima*, *Ceraphron carpenteri*, a *molobrus*, an *attica*, a *smynthurus*, and several *aphides* — were supposed, by various close observers, to be either originators of some forms or accompaniments of the disease, or powerful accelerators of its general progress. Swarms of some of them seem undoubtedly to have infested the potato crop, — probably to a degree far greater than ever before occurred; and, though not at all likely, in even one instance, to have originated the disease, they must have seriously aggravated it, and perhaps sometimes complicated it, by puncturing the plant's organs, abstracting its juices, and laying it widely open to chemical disarrangement, fungal lodgment, and atmospheric action. A particular theory, however, selected the *Aphis rapæ* or *Aphis vastator*, as the grand depredator, and even cried it up as the certain and sole parent of the whole. This theory was the most popular one in England in 1846; insomuch that, for months together, multitudes talked incessantly of the aphis, and seemed to have gone into an aphis-mania, and would not listen to another theory. Yet, though both facts

and philosophy now pour derision on this theory, they fully admit every abounding aphid to be very mischievous, and loudly warn all cultivators to adopt every preventive or remedial means against it in their power.

Common canker, or vegetable gangrene, exactly similar to the canker of fruit-trees, and to the "damping" or "shanking off" of badly-wintered cauliflowerers, and of cucumbers and melon-plants, is believed, by the eminent Mr. Graham, to have been the true cause. According to him, the potato-plant, having been rendered partially inert by the repellent action of cold, wet, and gloomy weather, uncongenial to its nature as an exotic from a warm climate, at that critical period of its growth when in the course of ordinary seasons it would have been about to acquire a strength and hardness, but during which time it was incapable of perfectly evaporating its redundant juices, for want of sunshine,—they accumulated in consequence, and became vitiated by stagnation in that crude state; and when fine hot weather ensued afterwards, the sudden rush of sap was too great for its debilitated tissues, and the diseased fluid showed itself at the surface in various places, on the leaves and stalks, sometimes in spots not larger than a pin's head, at others in blotches, which rapidly increased if the stimulus of heat was kept up; and the virus of these spots, being of an ulcerous nature, eventually descended into the potatoes. The only effectual remedy, if it may be so called, is to pull up the haulm entirely, as soon as the disease has seized on the stalks; cutting off the haulm will not be so effectual, in many instances, as the lower parts of the stalk are often as bad as the upper parts. After all, however, Mr. Graham himself admits that the disease sometimes begins in the tubers, and even states that it usually commences in the underground parts.

A peculiar atmospheric action, similar to what produces influenza in man, is supposed by Liebig and Klotzsch to be the special cause. Liebig, in his work on the Motions of the Fluids in the Animal Body, after explaining the great importance of the cutaneous and pulmonary transpiration to the life and health of animals, goes on to contend that in plants the transpiration from the leaves is the chief cause, aided by the pressure of the atmosphere, of the motion of the sap. He then refers to the old but valuable researches of Hales, who demonstrated the importance, as well as the extraordinary power, of the transpiration of plants, and explained the frequent blight in hops, and other plants, by the action of an atmosphere saturated with moisture, and therefore unfit to support transpiration, in suppressing the transpiration from the leaves, and thus arresting the motion of the sap, which then putrefies and leads to the death of the plant. The putrid sap becomes a fertile soil for the seeds of microscopic plants, fungi, &c., and these are further propagated by seed, so that the soil may become infested by them. Liebig then proceeds to contend that the potato-plant is one of those which, like the

hop, suffers greatly from suppressed or impeded transpiration ; and that the potato rot has long been known, and was even very accurately described by Parmentier, who introduced the potato into France ; but that the peculiar atmospheric condition to which he ascribes the disease had never till of late years occurred over whole countries, but only locally. He considers the real cause of the disease to be an atmosphere loaded with moisture and cold, these being the conditions most unfavorable to evaporation ; and he shows that in 1845, and 1846, when the disease overran Europe, damp, cold, and rainy weather followed heat and drought, just at the period of the most luxuriant growth of the potatoes. This state of the atmosphere he considers to be the same as that which causes influenza in the human subject, by suppressing the cutaneous transpiration. He further shows that the very life of a plant depends on the resistance it offers to the destructive influences of the atmosphere ; and that the life and health of plants depend on the equilibrium of external causes, only one of which, — the state of the soil, — is much in the power of the agriculturist. One day, or a few degrees of cold, may be decisive as to the life or death of a plant ; so that it is of the utmost importance to strengthen the plant, so as to enable it to resist the external influences tending to destroy it. Now, Dr. Klotzsch has come to similar conclusions, — and shows that, as the potato is cultivated for its tubers, there is a great loss of nutrient matter if it be allowed to form flowers and fruit ; and he concludes that if this be prevented, the nutrient matter will be sent in the direction of the tubers and roots, and thus the plant will be strengthened, and enabled to resist disease. He proposes, therefore, when the plants are from six to nine inches above ground, to pinch off the ends of the stems and branches for half an inch only downwards from the point, and to repeat this four weeks later. In some experiments made by him, in which the alternate rows were treated in this way, the result was, that the rows not so treated were straggling and sickly, and had scabby tubers, liable to rot ; while the rows so treated were bushy, luxuriant, dark-green, with very numerous tubers, clean, and free from all disease whatever. But whatever may be thought of the remedy, or however fair or deserving a subject of experiment it may be as to the general strengthening of the potato-plant, the alleged cause seems a great deal more than doubtful. To say nothing of grave physiological objections to it, the very facts on which it rests are contested. A diminution of temperature to the extent of six or eight degrees is exceedingly trivial, and must often have occurred in former years, when this disease did not occur. Nor is the potato-plant of so delicate a texture as to be unable to stand much greater diminution and irregularities of temperature than what occurred in 1845. The fact that it grows equally well in the Shetland Isles, with an average temperature of 46° 3', or even in hot-houses, with a temperature

of thirty or forty degrees higher, must satisfy any one that the temperature of 1845, though undoubtedly lower than usual, and irregular in its progression, cannot account for the failure. The heat of 1846, too, when the disease was more virulent and extensive than in 1845, instead of being below the average, was actually a little above it; and the fall of rain, as ascertained at a great many places, though unusually fitful, and sometimes exceedingly heavy, was not aggregately much above the average, and did not anywhere produce an excess of cloudiness, or any material excess of moisture.

An atmospheric influence of some less specific or more diffusive kind than that contended for by Liebig and Klotzsch has been regarded by many distinguished British agriculturists as the cause. But the views entertained respecting it are at once various, conflicting, and vague. Some say that it was merely a decrease in the temperature about the time of ripening of the tuber, by which this disease was caused. Now, in 1846, it returned at a much earlier period than in 1845. Was the time of ripening hastened? and if so, by what cause? And is there any evidence that such a decrease in temperature took place in 1846? or that it existed everywhere in 1845? Other defenders of the same theory assume that it was the sudden change of wet and cold to hot weather by which this calamity was occasioned; and others state, in addition, that the unripe condition of the seed from the former year, and the protracted cold of the ensuing winter, preventing the due preparation of the land, were either the aggravating or the chief causes of the disease. Did these circumstances occur in 1846, and were they general wherever the disease prevailed? If we further come to the manner in which this atmospheric influence is said to have acted, then we meet again several vague expressions, and find that unproved things are taken for granted. Some speak of the organism of the potato having become repleted with moisture, and, therefore, the pores being checked by some of the above circumstances, exceedingly liable to undergo putrefaction. Others are of opinion, that one constituent of the organism of the potato has been produced to the disadvantage, at the expense of, or at least in greater proportions than the others; and that this, no matter in what way, has been the cause of a weakened organism, and consequently of the disease. Others, again, explain the action of the atmosphere as merely serving as a vehicle to myriads of minute seeds of fungi, which, when the air is in a comparative rest, should be enabled to enter into the minute pores or stomata, which exist chiefly on the surface of the leaves. This is merely a modification of the fungal theory.

Some miasmatic substance, or deleterious gas, or other subtle and unusual body in the atmosphere, is supposed, by Count Gasparin, Milne, and others, to have been the cause. The principal, real, or alleged facts,

appealed to in support of this theory, are that the disease was averted from some localities by screens, shelter, and other means of protection from the external air, — that, in the successive years of its ravages, it moved off from some districts and countries, and made invasion upon others, — that, during the summer and autumn of 1846, it broke out, in a progress from south to north, on the continent and in Great Britain, as if it proceeded in a somewhat regular march, — and that it did not attack portions of fields which were exposed to the smoke of steam-engines and of copper-works. It is inferred from the last of these facts that the noxious substance was some acrid gas or vapor capable of being neutralized or altered in its nature by chlorine, common smoke, and the fumes of arsenious and sulphurous acids; and, in support of this view, an experiment of Professor Christison is cited showing that sulphurous-acid gas, when mixed with atmospheric air in the minute proportion of one part to nine thousand, injures the leaves of a mignonette, of a laburnum, and of a larch-tree, placed in it for forty hours. But, though the gaseous or miasmatic theory accords well with some of the phenomena and circumstances, it seems violently incompatible with others. A peculiar state of the electricity of the atmosphere is supposed by some persons to have been the cause. Electricity is now known to act a powerful part in all normal vegetation; ordinary electricity acts constantly, in seeming concurrence with all the chemical processes of decomposition and recombination, both upon plants and within them; extraordinary electricity, or great and sudden disturbances of the normal electric conditions of the atmosphere, or of the normal relations between the electricity of the air and the electricity of the earth, seem to produce effects analogous to those of either invigorating or overwhelming excitement; and the electric phenomena of a large portion of the period of both 1845 and 1846, throughout which the potato disease broke out and spread, were not a little remarkable for at once singularity, unsettledness, violence, and aggregate duration. The results of an experiment in electro-culture, reported to the Royal Dublin Society, were also most arresting; — the rods had been put up, according to Dr. Forster's method, in a remote part of a potato-field, in order to test their effect upon the invigoration of the crop, — and they were afterwards neglected or forgotten, in consequence of the apparent seizure of the whole field with the potato disease; — but when the spot which they protected came eventually to be examined, all the potatoes in it were found to be sound and excellent, while those of the rest of the field had died and rotted. Other remarkable facts, directly ascribable to electric influence, or apparently resulting from it, or controlled by it, were observed; and several theories corresponding to them, but widely differing as to both the *modus operandi* of the electric influence and the most suitable or effective means

of averting deleterious effects, were formed and advocated, and have been received more or less extensively as plausible. The present state of scientific knowledge, however, is far too obscure to enable any man to follow out a speculation on the supposed connection of peculiar electric conditions with the originating of disease in plants; and the utmost which the speculation about electricity and the potato can do, is to suggest a hope, that in some more advanced stage of the rapidly-careering progress of scientific discovery, a subject which is now so mysterious and bewildering may come to be perfectly explained.

Remedies. — We have now gone over all the chief and most plausible theories; and, since the result is unmixed uncertainty or utter confusion, we might seem to have had all our labor for worse than nothing. But, when it is seen how entirely the most distinguished savans have been baffled, and how completely all science and experience and observation have been stultified, by the potato disease, all persons must readily assent to the suggestion that the potato can no longer be depended on as an extensive and staple article of sustenance for the human family, and that its loss must be made up by the substitution of another and more reliable vegetable production. Whatever others may say or think, it is certain that, until the cause of this disease is known, no efficacious remedy can reasonably be expected to be found. It is the department of science to proceed from fixed points, from causes into effects; and every other way is hardly deserving of any other name than that of empiricism. We would go further still, and say, that even although the cause were duly known, however indispensable this may be, we could not, however, from the defective state of our knowledge of the physiology and pathology of plants, undertake the cure with the same confidence of success with which the physician places himself before his patient, to attack and overcome an illness. But still, without being acquainted with the cause of the disease, a variety of remedies will be tried in vain, and, what is worse, remedies which may easily injure a plant which has frequently been unnaturally cultivated. The steeping in dilute sulphuric acid, dusting with lime and gypsum, the application of sulphate of copper, arsenic, &c., may prove beneficial for the moment; but how all this will affect or alter the nature of the potato, it is only for future experience to make out. Such kinds of treatment will be resorted to, if we proceed upon the belief that a fungus acts as the cause of the disease. The purpose is to kill the enemy; but does one always sufficiently consider that the injury intended for it may not also affect its victim? But if we adhere to the opinion that the unfavorable state of the weather has been the direct cause of the disease, by — no matter in what way — altering the functions of the plant, then there is certainly something true in Morren's remark, that this theory, in point of

curing the disease, is dangerous in its effects upon the mass of farmers, who, being powerless against such an enemy, may easily fall into that state of indifference which in former times was too characteristic of their class. The remedy which results from the application of the epidemic theory seems certainly to be entirely in the power of the farmer, without being attended with the injurious effects that may follow from the attempt of destroying the parasite directly, — we mean the enclosure of the potato-fields, to prevent the supposed introduction of the imagined seeds of the parasites by currents of air. Yet, if this remedy, as is likely, might prove ineffectual, the opportunity of preserving the crop is gone, and the evil will rage on undisturbed. But there is something more reasonable in the idea, to turn the whole attention to the diseased plant itself, — to allow those plants to be lost that are hopelessly attacked, to be cautious in attempting to employ the less diseased for seed, and to be satisfied with employing what has hitherto escaped, either of fine or of coarse varieties. If this be accompanied with judicious cultivation, — if sound seed, chiefly from varieties that have suffered least, be planted in soils similar to those where the disease has least prevailed, — and if the methods be imitated of those who have had small or moderate, but comparatively sound crops, — as well in regard to treatment, kind and quantity of manure, and period of application, as to depth of planting, distance between the plants, and time and mode of cutting, — then something is put into the power of the farmer, which, being faithfully copied from the prescriptions of nature, may justify the persevering man in expecting a slow but gradual and continual remedy, and recovery of what has been lost.

A method was discovered, about the year 1840, by M. Zauder, of evading the attacks of all potato diseases, by raising full-grown tubers from seed in one season ; and this method was reported by Mr. Hogan to the meeting of the British Association at Oxford, and was ascertained, from his personal observation of it in two widely separated localities in Germany, to have proved perfectly efficient as respected its yearly or current success, yet was declared to need confirmation and improvement, by many experiments, in various places, and under various circumstances, before it could be relied on for rendering seedlings healthy or disease-proof, in years subsequent to their being produced. The statement of M. Zauder himself, in his own language, is as follows : — I first raised potatoes from seed seven years ago. I sowed an eighth of an ounce, and obtained nearly seven sacks of full-grown, perfectly sound potatoes, although in the same year almost all the potatoes in the same neighborhood were affected by pock-mark and dry-rot. I have regularly raised potatoes from seed ever since, and they have remained sound during the whole time ; and in the year 1845 when the disease had

spread over all Europe, and attained the greatest virulence in this neighborhood, those potatoes which I had previously raised from seed, as well as those of the preceding year, continued perfectly exempt from disease. I have given potatoes raised from seed to others, and those have also remained perfectly free from the universally prevailing disease. From an ounce of seed may be raised upwards of fifty ordinary-sized sacks of potatoes. The seed is saved in the following manner: the berries should be gathered in autumn, before the frost sets in, and be preserved in a dry place, where frost cannot reach them, until the end of January, when the berries should be broken by the hand, and placed in a tub or other vessel, for six or eight days, to ferment; water should then be thrown on them and well stirred, in order to separate the pulp and husks from the seed, which should then be dried and cleaned, and kept in a warm, dry place, until the middle of March. At the latter time, or in the beginning of April, the seed should be thinly sown in a hot-bed, and by the middle of May there will be fine healthy plants, which may be put out into the field; care should be taken to put them out before they form tubers, and the seed-bed should be kept moderately moist while they remain in it. They should be planted out after rain, and be put at about the same distance from one another as potatoes generally stand in the field.

SMUT.

Description.—This is a disease of the ears of growing grain, filling the grain with a fine, sooty-looking powder, in the room of farina. It arises entirely from two minute coniomycetous fungi,—the *Uredo segetum* and the *Uredo fætida*; but it attacks all sorts of corn grain, and presents a great diversity of appearance, and bears a number of popular names, and has been erroneously ascribed, by all classes of cultivators, to a great diversity of causes. Some farmers, seeing only a very few ears of a crop perceptibly affected with smut, regard the evil as of small consequence, and are totally unaware that when no more than one smutted ear can be found in a sheaf, the straw of the apparently sound plants may want so much as one third of its average weight, and the grain so much as three sevenths; and other farmers, who may have a correct opinion enough of the mischievousness of smut, are so misled by false notions of its cause, as either to reject all suitable preventives and remedies of it, or to adopt them empirically, and without sufficient confidence and vigor.

Causes and Phenomena.—Some of the many erroneous causes which have been assigned for smut have no connection with it whatever; and others are mere contingencies, which either aggravate its symptoms or accelerate its progress. One alleged cause is, deficient fecundity, in consequence either of the pollen being washed away with rains, or of its undergoing some

chemical change of a putrefactive nature ; but smut is found to affect the organs of fructification, and either to impair or to destroy them, long before the pollen can be formed. Another alleged cause, sanctioned, long ago, by the distinguished Jethro Tull, is humidity of the atmosphere, or the prevalence of fogs, or the bursting out of intense sunshine while the crop is in a moist condition ; but this notion has been disproved by some carefully conducted appeals to experiment, and is disproved also by the general fact that smut is sometimes observable in an early stage of the plant's vegetation, long before it has escaped from the leafy envelopes. A third alleged cause is, excessive moistness of the soil, — and certainly this, though not a cause, is a very powerful provocative, insomuch that well-drained and thoroughly aerated soils are incomparably freer from attacks of smut than wet ones ; but the disease occurs on even the driest land, and may often be observed as rife in the dry parts of a field as in the wet parts. A fourth alleged cause, sanctioned by such names as Somerville, Walker, and Linnæus, is the hatching and feeding of minute insects ; but this opinion has been refuted by express and searching observation, and may be exploded also by the general fact that acari and aphides, and other minute insects, feed more or less on all sorts of plants, whether affected by smut or not, and almost always abound on decaying vegetable matter, or on plants which are in a diseased or enfeebled condition. A fifth alleged cause is, the abrasion of the seed-corn in the process of threshing ; but seeds threshed in exactly the same way run to smut in some seasons, and do not run to it in others ; and numerous grains of wheat of different sizes have been experimentally bruised with a hammer, previous to sowing, and have not been found to produce smutted plants. A sixth cause alleged is, monstrosity of embryo ; but male flowers, or male parts of flowers, as well as female ones, are liable to smut, and they have no embryo. A seventh alleged cause is, deficiency of nourishment, occasioned by poverty of soil, or by crowdedness of crop ; but diseases closely akin to smut attack the fructification of some perennial plants, whose roots and stems, from year to year, are so vigorous as to indicate the presence of ample nutrition. An eighth alleged cause is, fermentation within the ears of corn, occasioned by natural humidity, or by excessive slowness of development and deficiency of evaporation ; but, if this were a true cause, it would account for the appearance of smut only after the seeds begin to be formed, and might be expected always to produce the disease in far greater extent than it is generally found to exist. Most other alleged causes are akin to some of those already named, or are exceedingly fanciful, or confound smut with some other and widely different diseases.

The two species of fungi which produce smut, or whose spores constitute the fine, powdery, sooty-looking substance of the disease, possess a some-

what close resemblance to each other, and are usually described under one general name ; yet not only have they separate specific characters, but they make specifically different developments in grain plants, and produce essentially different economical effects on crops ; and they therefore require to be separately studied, and distinctively understood. The *Uredo segetum* is much more minute than most other coniomycetous fungi which attack graminaceous plants ; and, in particular, is not half the size of *Uredo fætida*. Its spores are so extremely small that not fewer than seven millions eight hundred and forty thousand would be required to cover one square inch. It first so injures the interior portions of the flowers of the plants which it attacks as to render them abortive ; it next makes the pedicels or little stalks of the florets swell and become very fleshy ; it next consumes the whole of this fleshy mass ; and it finally comes through the epidermis, and appears between the chaff-scales in the form of a black, soot-like powder, and looks as if adhering, by means of some gummy substance, to the young ear. It operates alike on wheat and barley and oats, and is essentially the same in them all ; but it differs widely in aggregate coherence upon wheat and barley, — and differs also in the microscopic appearance of its spores, — but probably owes the differences entirely to the different action of the matrices in which it grows. It commonly attains maturity some weeks before the crop which it infests is ready for the sickle ; and it then is a light, loose powder, resembling very fine lampblack, and is swept away and scattered by the winds, so that, even when it has made great havoc upon a crop, it is seldom seen to any considerable extent at the time of harvest. It has sometimes been found to attack the leaves and the culms of corn-plants ; but, in general, it attacks only the ear, and this it completely destroys. It is comparatively rare in wheat, and does not seem to occur at all in rye ; but is very common in barley, and still more so in oats. It has also been observed in several of the forage grasses. Some farmers absurdly think that a little of it in the barley crop is a good sign ; and most regard it as far less mischievous than *Uredo fætida*. But, in so far as it exists, it is always and entirely a desolating evil ; and it both escapes the observation of superficial observers, and eludes some of the common methods of preventing or extirpating it, by the early maturation and profuse dispersion of its spores ; and though really a less evil, comparatively, than *Uredo fætida*, it is a much greater one absolutely than most farmers suppose.

Grain containing some mixture of smut has not been observed to injure fowls who eat it ; and yet, the straw of smutted plants is asserted to be distasteful to cattle. The effect of the fungus upon the wholesomeness of crops, in fact, is little understood, and does not seem to have been tested by any good published experiments ; yet it may be pretty closely estimated by

reference to the known chemical composition of smutted grain. Chemical analysis has demonstrated that the *Uredo segetum* effects an entire decomposition of the vegetable constituents of the grain it infects, the saline constituents of the grain remaining nearly unaltered. Parmentier, Cornet, Girod Chautrans, Fourcroy, and Vauguelin, have successively examined it; and the result of their researches is, that smutted grains of wheat are composed, first, of about one third their own weight of a green, butyraceous, fetid, and acrid oil; second, nearly one fourth of a vegeto-animal substance, perfectly similar to that which comes from putrid gluten; third, a black coal, one fifth of their weight, similar to that which is found in all remnants of putrefied organic compounds; fourth, free phosphoric acid, amounting scarcely to more than .004 of the smut, — and fifth, phosphates of ammonia, magnesia, and lime, in the proportions of a few thousandths. It is stated that, in one examination of putrefied gluten, characters were found very similar to those of the smut of wheat; and that the products of the one are so like those of the other, as to render it difficult, in certain cases, not to confound them together. It requires a man to be well practised in chemical experiments, to discern the slight differences that exist between these two putrefied matters, because the differences are only delicate shades, not easily discernible. The contagion attacks especially the gluten, and precedes, — indeed, prevents, — the formation of the starch; since we know positively that this fecula, no traces of which are found in the smut of wheat, suffers no alteration from that septic process, which so powerfully attacks the glutinous substance.

The *Uredo fatida* occurs only in the grain of wheat, and is a well-known and much dreaded disease. It may be detected in the young seed, even in the very earliest states of the flower-bud; and when fully ripe, it most frequently occupies the whole interior of the grain. The earliest period at which M. Bauer discovered it within the cavity of the ovule of a young plant of wheat was sixteen days before the ear emerged from the base, and about twenty days before the sound ears, springing from the same root, were in bloom. At that early stage, the inner cavity of the ovum is very small, and, after fecundation, is filled with the albumen or farinaceous substance of the seed, and already occupied by many young fungi, which, from their jelly-like root or spawn, adhere to the membrane which lines the cavity, and from which they can be easily detached, in small flakes, with that spawn. In that state, their very small pedicels may be distinctly seen. At first, the fungi are of a pure white color, and when the ear emerges from its base, the ovum is much enlarged, but still retains its original shape; and, the fungi rapidly multiplying, many of them have then nearly come to maturity, assumed a dark color, and, having separated from the spawn, lie loose in

the cavity of the ovum. The infected grains continue growing, and the fungi continue to multiply, till the sound grains have attained their maturity and full size, when the infected grains are easily distinguished from the sound ones, by their being generally larger and of a darker green color; and, if opened, they appear to be filled to excess with these dark-colored fungi. But the grains infected with the *Uredo fætida* very rarely burst, and these fungi are seldom found on the outside of the grain; but if a grain be bruised, they readily emit their offensive smell, which is worse than that from putrid fish. When the sound grains are perfectly ripe and dry, and assume their light-brown color, the infected grains also change, but to a somewhat darker brown, retaining, however, the same shape which the ovum had at its formation, the rudiments of the stigma also remaining unaltered. The spores which fill the grain constitute a fine, black, disgusting, fetid powder, and amount to about four millions in a single grain, and may be easily distinguished and examined through a microscope, and have then the appearance of articulated globules growing in a bundled manner upon threads; but the sporules which they contain, and which propagate the smut in the same general way in which seeds propagate phenogamous plants, are so surpassingly minute as to be scarcely distinguishable under very high powers of the microscope, appearing then only like a faint cloud or vapor in a puffly escape from the spores.

The *Uredo fætida* not only destroys all the grains or plants which it directly attacks, but greatly deteriorates the value of the sound part of the general crop. The disgusting odor which it emits may be perceived on passing through a field where it prevails; and becomes cohesive to the fingers, and intolerable to the sense, when an infected ear or two are broken in the hand; and diffuses itself sufficiently through the sound grains, by the contacts of growing and harvesting, to render the flour made from them perceptibly malodorous, and comparatively unfit for bread. Ready purchasers, however, are found among the manufacturers of gingerbread, &c., in some countries, who have discovered that the treacle, and whatever else they mix up with it, effectually disguise the odor of the fungus; and while such a mode of employing the tainted flour would be perfectly unobjectionable if the odor were innoxious, it becomes censurable and wicked when good reason exists for suspecting the odor to be seriously unwholesome.

The sporules of both *Uredo segetum* and *Uredo fætida* were long believed and have been proved to find their way into corn-plants, by entering their spongioles with the moisture, and ascending their interior with the sap. There is little doubt, according to Johnson, but that the mode in which smut is imparted to the plant is by its roots imbibing the extremely minute seeds of the fungus along with the moisture of the soil; and this opinion is

confirmed by the observation that the disease is most prevalent when the winter has been mild, and the spring wet, — for in such seasons the abundant moisture passing through the soil is most likely to convey the seeds to the mouths of the plant's radical fibres. The distinguished Mr. Sidney remarks, that, though the surmise of most observers has been that the sporules enter by the roots and circulate in the plant, still, no one has yet seen them grow; nor would this be the normal mode of growth. The spores themselves are undoubtedly too large to enter either by the stomata of the leaves or the spongioles of the roots. Some ingenious experiments have been made, that appear to establish the theory that these contents of the spores do enter the plant in the way suspected, and grow. The mode of proceeding was to immerse some seeds of wheat in water containing bunt. One of the first appearances was a curious mould, with peculiar spores, that sprung upon the spores of bunt. The plants which came up from these seeds were evidently affected; but no communication whatever could be traced between the cells of these plants and the shoots thrown out by the spores. No intrusion whatever of the mycelium developed by the bunt-spores into the wheat could be discovered. This looks, therefore, as if the fine contents of the spores do certainly propagate the fungus. Professor Henslam states, that, although the bunt-fungus confines its attacks to the young seed, it seems to be a condition essential to its propagation that it should be introduced into the plant during the early stages of its growth, and that its sporules are most readily absorbed by the root during the germination of the seed from which the plant has sprung. It has been clearly proved that wheat-plants may be easily infected, and the disease thus propagated, by simply rubbing the seeds, before they are sown, with the black powder, or spores, of the fungus. It is also as clearly ascertained that, if seeds thus tainted be thoroughly cleansed, the plants raised from them will not be infected; and this fact is now so well established, that the practice of washing or steeping seed-wheat in certain solutions almost universally prevails.

Preventives. — The chief preventive of smut in wheat is the steeping of the seed-corn in some suitable solution. The spores which, at the time of threshing, are dispersed from smutted ears in the form of a fine powder, and which attach themselves to the sound grains, adhere with considerable obstinacy by means of an oily or greasy matter in their own substance, and cannot be thoroughly cleaned away except by means either of an alkali which shall combine with the oily matter and convert it into soap, or of some powerful substance, which shall be adverse enough to vegetable life to kill the spores, and yet not so adverse as to kill or injure the grains. The substances most commonly employed in alkaline steeps are lime, and salts of soda, potash, and

ammonia; and those of a killing kind most commonly employed are arsenic, sulphate of copper, nitric acid, muriatic acid, and sulphuric acid. The use of poisons, however, — particularly violent ones, — is altogether unnecessary, and very dangerous, and not a little culpable; and the use even of excessively pungent substances, which are not strictly poisonous, is never so politic, and perhaps never so efficient, as that of the alkalies, or of common salt, or of some mixture of saline substances.

The experiments of Mr. Bevan indicate that lime-water is the most effective of these preparations; and if this be adopted, it may be prepared by mixing one pound of fresh lime with three gallons of boiling water, allowing these to stand for two hours, and the clear liquor then to be poured off, and immediately used. In this liquid the wheat should be soaked for twelve hours, stirred twice or thrice during the time, and then mixed, upon a floor, with the powder made by pouring three gallons of boiling water upon five pounds of lime. He remarks further, that he has had no experience of the effects of lime-water as a preventive of the smut; but, with stale urine and a solution of common salt, numerous and expensive experiments were made, the results being, without exception, favorable, and nearly similar; and this being the case, a preference is to be given to common salt, as being decidedly the best in all material points. The mode observed to be the most effective is to wash the seed with pure water, pouring this off with all the floating grains, and then allowing the seed to soak for twelve hours in a solution of common salt, having a strength, or specific gravity, sufficient to float a common hen's egg. A solution of sulphate of soda, in coöperation with an application of lime, was found by M. de Dombasle, after many experiments, to be the most efficient steep. The solution requires about $17\frac{3}{4}$ lbs. of the sulphate in 22 gallons of water; and as this salt does not very readily dissolve, the solution ought to be commenced a day or so before it is wanted, and frequently stirred, till all the salt is dissolved. The grain is to be formed in heaps on the floor, which are to be completely moistened with the above wash, by means of a watering vessel. During the time the wash is being poured over the heaps of grain, they must be kept constantly stirred about, by means of wooden shovels, till the whole be perfectly moist, which is known by the wash running from the heaps after they are sufficiently saturated. After the grain is well moistened, lime, in powder, is to be immediately thrown over the heaps, in the proportion of nearly $4\frac{1}{2}$ lbs. to the 22 gallons of grain; this is done gradually, while the grain is to be turned over in every direction, so that the whole may be intimately combined. When this is done, the grain may be either sown immediately, or kept for some days, in which case it may be turned over every three or four days.

The use of any kind of steep, however, is a preventive of smut only as propagated by the adhesion of spores to the grains of the seed-corn, and can have no efficiency whatever against the germination of spores which lie lodged in the soil independently of the seed-corn. Mr. Johnson remarks, in addition, that, although it is very apparent that the smut is generally imparted to a wheat crop by the agency of the seed sown, yet he is by no means of the opinion that this is the only source of infection. He had kept ears of wheat, that were covered and destroyed by the *Uredo*, during more than twelve months, in a situation where they experienced the vicissitudes of temperature during all the seasons, unprotected by more than the paper envelope in which they were suspended in an out-building. Yet, when the *Uredo* that had been thus exposed was mixed with healthy, well-washed seed-wheat, this produced diseased plants in a triplicate proportion more numerous than that not so mixed. This experiment demonstrates that frost and drought, acting in concert with a damp atmosphere, do not destroy the vegetating power of the *Uredo*'s seed. Such being the fact, why may not this seed remain in the soil, ready to impart the plague? We know that, owing to its lightness, this seed floats buoyantly in the air, and may be carried by winds to distant soils, which, in the autumn of the same year, before any extremity of cold has been endured, will have to bear the wheat crop for the following harvest. The opinion that the soil is one source of infection is sustained by the fact that fields in the vicinity of the sea are rarely injured, and never extensively, by the ravages of the smut. Such soils are impregnated more than any other with common salt, and the effect of this saline compound upon the *Uredo* has been noticed already. The spores of *Uredo segetum*, too, are so generally shed and dispersed before the harvesting of the crop, that they may be supposed to lie lodged in immense numbers in every part of the field, or farm, or district, where they were produced; and even in so far as they adhere to the grains of barley and oats in the same manner in which those of *Uredo fatida* adhere to the grains of wheat, they have such a peculiarly strong hold in connection with the integuments of these grains, that they cannot very readily be reduced or killed by means of steeps. As regards some smutted wheat-lands, therefore, and especially as regards all smutted barley-lands, and all smutted oat-lands, other preventives and remedies must be brought into requisition, and should be such as to secure the utmost possible cleanness of both the seed-corn and the land, and will, after all, be found incompetent to effect an entire cure. The obtaining of seed-corn for any farm from other and distant soils is recommended by Tull, Donat, Lignerolle, and others; but, however beneficial this may be for securing other desirable effects, it can be

useful in regard to smut only when the seed-corn is brought from a district remarkably free from that disease. All the preventives and remedies which address themselves to the state of the land, or consist in special processes or methods of culture, are the same in the case of smut as in that of mildew.

COTTON ROT.

Description.—This disease makes its first appearance as a small, dark green, circular spot, on the outside of the boll, and many of them are frequently present on a single boll at the same time. The progress of the disease varies—being sometimes rapid, and at other times tardy—most probably influenced by the temperature of the atmosphere, or the condition of the plant; but, with the advance of the disease, the spots change color, and gradually assume a blackish-brown hue, until the entire boll is affected. If suddenly checked, as sometimes occurs from an unexplained cause, only a portion of the boll will be discolored. In the first case the disease has penetrated to the centre of the boll, which ferments, and pours out a white, frothy liquor; after which putrefaction follows, involving the destruction of the seed and immature cotton, when the rind, or exterior coating of the boll, being exhausted of its juices, hardens and turns black. When suddenly checked in its operation, the disease will be found to have only partially injured some of the bolls, and the interior of others not at all—these will mature and expand. This, however, is seldom the case, as the boll is subject to a succession of attacks until it is finally destroyed; being liable to the ravages of the disease from the period of its first formation, until that stage of perfection is reached which immediately precedes development.

Cause.—All research has hitherto failed to ascertain the originating cause, and, consequently, no remedy can be intelligently applied. It has been supposed to be occasioned by the larvæ of a small insect, hatched from eggs deposited in the boll at an early period of its development, which, by feeding on the seeds, produce the disease; and a boll, thus affected, when divided, usually contains a varied collection of small insects in different stages of metamorphosis. On the other hand, it is urged that the presence of insects in the rotted boll proves nothing more than that they probably crept into it for food and shelter after it had been destroyed by the disease. The insect theory does not seem to be borne out by the result of close observations, which prove that, while one cotton plant is a prey to the disease, others in the immediate vicinity are comparatively free and healthy; as many as seventeen rotted bolls having

been counted upon one plant, while its near neighbors were luxuriantly green, and unmarked by the least sign of the disease. Insects seem to be attracted to the decaying bolls by the sap which exudes from the wounds, and thus the effect is mistaken for the cause. Equally as unsatisfactory is its reference to a defect in the soil, or in the manure; for here, again, are the advocates of this theory met by the fact, that all the plants growing on the same soil, and similarly treated, are not affected with the disease. Much may depend on the constitution of the plant, derived from imperfect or immature seed; and a careful selection of well-ripened seed, from sound and healthy plants, might do much toward eradicating the disease.

COTTON RUST.

Description.—A parasitical fungus grows upon the stem and branches of the plant, which exhausts the sap, and causes the leaves to wither and fall. The leaves assume a yellow color, and are frequently spotted with red.

Cause.—It is generally traceable to defective cultivation, and may be remedied by adopting such a system of agriculture as will restore to the soil its abstracted salts and phosphates.

COTTON BLIGHT.

Description.—This disease, although mistaken for rust, is of itself a distinct affection. The leaves suddenly wither, droop, change to a brown color, and then fall off; and the bolls shrivel and dry up. The entire plant dies in a very short time; the pith of the root, stem, and branches, presenting that blackish-brown appearance which usually accompanies an advanced stage of decay.

Cause.—Experiments have proved that it is the result of planting cotton for a series of years on the same land, and that it may be prevented by a judicious rotation of crops.

SORE SHIN.

Description.—This is another affection of the cotton plant, which makes its appearance in the early stages of its growth, during the prevalence of cold nights in a wet and backward spring. The bark of the stem becomes callous, and the sap vessels are dried up, or obstructed near the surface of the ground. If the plant continues to live, its

growth is slow and languid, and it never regains its former strength and vigor.

Cause.—This malady has been attributed to early planting, but it is, doubtless, really caused by the ravages of the cotton-louse, which debilitates the plant by abstracting the sap.

CHAPTER XIV.

NOXIOUS INSECTS AND ANIMALS.

INSECTS WHICH LIVE CONSTANTLY ON OR IN DOMESTIC ANIMALS, AND PROPAGATE ON THEM — INSECTS WHICH INJURE GRAIN — INSECTS INJURIOUS TO CULINARY VEGETABLES — INSECTS INJURIOUS TO FRUITS, FRUIT-TREES, SHRUBS, AND VINES — INSECTS INJURIOUS TO FLOWER-PLANTS — INSECTS INJURIOUS TO MEADOWS — INSECTS INJURIOUS TO THE COTTON PLANT — ANIMALS INJURIOUS TO CULTIVATED FIELDS.

I. INSECTS WHICH LIVE CONSTANTLY ON OR IN DOMESTIC ANIMALS, AND PROPAGATE ON THEM.

Lice. — Among insects which continually live on domestic animals, propagate on them, and, when their numbers are too great, cause serious injury to them, the various species of lice hold the first place. These animals are much to be dreaded when they have increased so as to produce the disease called *Phthiriasis*, and when this settles into a confirmed chronic evil. In horned-cattle lice have no particular favorite place. They run up and down over the body of sheep, causing a separation of the wool from the skin. They swarm in every part of swine, and even grow into the skin, muscles, &c. They may be occasioned by dirt, insufficient food, or want of bodily exercise, or by previous disease. The remedy prescribed is, to take a common pair of bellows, and a bellows-pipe fixed to its side, which is to be filled with inferior tobacco, and set fire to; one man holds the sheep between his legs, another parts the fleece in various places, and a third blows the tobacco-smoke on the skin, fumigating by degrees the whole body. The sheep must be kept some time in the open air after this. Ox-lice are to be expelled by washing with an infusion of *Staphysagria* powder and crushed pepper in strong vinegar. For lice in swine, use internally the black sulphuret of mercury, mixed with salt, and wash the parts most infested with arsenic acid.

Horse Bot. — The horse bot is the larva of a fly resembling a humble-bee, with two wings. The female lays her eggs on the shoulders, manes, and knees of horses, which they lick off and swallow. They hatch in the stomach, feed in the larva state all the winter on the mucilage, and in spring are found in the horse's stomach, sometimes in great numbers. They resemble in size and form a date-stone, having two hooks at the fore end, with which they adhere to the inner coat of the stomach, often pen-

etrating from $\frac{1}{4}$ to $\frac{1}{2}$ an inch deep into the white insensible tissue, and become as if distorted by it. If numerous, they cause violent pain; and, as they irritate the stomach, and extract a great deal of nourishment from the

Fig. 351.



animal, they necessarily injure digestion. The American arbor vitæ, administered inwardly, and the expressed juice of the common elder, either alone or mixed with tar, will be found effectual in protecting cattle from bots and intestinal worms. The leaves and young shoots of the arbor vitæ are to be beaten in a mortar with a little water, and the juice expressed. The horse is to take a quart, as a preventive remedy, every quarter of a year, on an empty stomach; and if the animal is very ill, this quantity is to be given thrice a week. An effectual mode of preventing the introduction of the bots into the stomach is also said to be, the washing off the eggs from the knees, mane, and sides of the horses, or removing them with a pair of scissors.

Fundament Bot. — The female of this bot lays her eggs on the lips of the horse, whence they are licked off and swallowed, and thus get into the stomach. The bot-fly itself is half an inch long, brown, unspotted wings, dark abdomen, with white base and reddish-yellow extremity. The larva resembles the preceding, and is also found with it in spring in the stomach of horses. Their color is not so red, their body has two rings less, and their hooks are longer and sharper. Their presence is known by the horse voiding them with excrement, or by their being found on the closing muscles of the anal opening. When thus convinced of their presence, injections of animal oil are applied, which kill the larvæ, and they are voided.

Ox Warble. — This insect is larger than the house-fly, and resembles the humble-bee. It has brown, unspotted wings, and on the abdomen, which is covered at the end with reddish-yellow hair, a black band. The eggs are laid on the skin of the back of oxen, one at a time. The eggs are hatched by the animal heat, and the larvæ cause swellings, generally about the size of a pigeon's egg, and are called warbles — worm-holes. The larva is without feet is dotted on the upper surface with very small grains, which

appear under the magnifier like short, triangular, yellow prickles, which create an irritation in the skin of the cattle, and also transport the larva to another place, when it has left its first station. It lives in the tumor from August till the next June, then pushes itself through and falls to the ground. Usually only from four to five tumors are found in one beast. Young, healthy, and fat cattle are most liable to be selected. The tumors may in many cases contribute to the health of the cattle, but when very numerous, the cattle grow lean, and the cows give less milk. To rid cattle of this torment, enlarge the opening of the tumor with a knife, and press the sides of the swelling, when the larva protrudes itself. The wound must be kept clean, and heals without further remedy.

Red Bot. — About the size of the honey-bee; thorax rose-colored; wings inspotted; abdomen black at the base, whitish-gray, set with yellow hairs at the further end. The female lays her eggs in the animal's nostrils, and the larvæ cause an itching in these tender parts, — frequently get into the cavities of the gullet, and cause much pain. They feed upon the mucus which they find in these parts, and when large enough tickle by their crawling, and are then thrown out by the sneezing of the animal. Sheep die when these insects are numerous in them.

Sheep Bot. — The thorax in the winged insect is brownish-black and dotted with white; the abdomen white, spotted with gray and black; the forehead ash-gray, covered with many small, deep punctures; the wings shining and dotted at the base. Lives in sheltered places, where it is numerous in warm days. The females lay their eggs in the nostrils; more than three or four are seldom found in one sheep, but they produce the staggers, and torment the animal greatly. The symptoms of their presence are nausea, weakness, sneezing, slow pace, turning the head, holding it down, and pushing itself against the nearest object; a shining, pus-like matter flows from the nostrils, often adhering so firmly to the apertures as to close them up, and cause difficulty of breathing. Besides these, dulness and indifference, swelling of gums and mouth, ulceration and convulsions, are produced by it. It also makes the sheep turn round frequently, exactly as if they were infested with the hydatids, which occasion the disease called the gid. The hydatid worm appears in lambs, much seldomer in yearlings, and still more rarely in full-grown sheep; it causes no defluxion from the nose, no symptoms of a disease, no sneezing, staggering, &c.; but the sick animal is lost without remedy. But in the disease caused by the sheep bot, the sheep in many cases cure themselves; the lambs are only attacked when out at pasture; and the diseased state of the pituitous unic of the nose is a clear sign that it is the sheep bot, and not the hydatid worm, that affects them. To remedy sheep thus affected, they are either

taken out alive, by trepanning the skull, as for the hydatids, or an attempt is made, by injections into the nostril of animal oil diluted with water, to kill them. Do not put sheep in pastures infested with the flies of sheep bot.

Horse Fly, or Forest Fly. — The fore-part of the body is depressed; head triangular; abdomen large and roundish, somewhat resembling that of a spider, — hence it has also obtained the name of spider-fly. The thorax is speckled with buff; the other parts are brown; the blunt, membraneous wings lie crosswise over each other. It prefers the abdomen of the animals, and attaches itself firmly to it. These flies are produced, or increase very rapidly, on animals that are unclean, or are in bad condition; and as they torment the animals very much, the following remedy must be applied, by which they can be got rid of in a day. Of mineral earth, take 8 oz., and of lard 1 lb., and make into a salve; rub it on here and there upon the hair, working it in with a wisp of straw. After twenty-four hours, wash off the salve with warm water in which brown soap has been dissolved. Keep the horse from getting cold.

Sheep Tick. — This animal has no wings. The fore part of the body is very small; abdomen thick-roundish, and proportionally very large. It sits sometimes on the skin of the sheep, under the wool, and sucks itself full of blood. Its color is pale red, the abdomen lighter, with an irregular white line on each side, and a red spot on the back. It lays only one egg, fastened to the wool; it is first white, then brown, and finally the perfect insect escapes from it. As a remedy for this insect, wash the infested sheep with a decoction of the crushed or bruised leaves of the common maple.

Bird Spider Fly. — Scarcely half as large as the forest fly, apple-green flat above, and has small, transparent, black-veined wings. It is found both on large and small fowls, clings firmly to the skin under the feathers, and annoys by its greediness for blood. It is difficult to rid the birds of this insect, for it runs backwards and forwards so fast that it can scarcely be caught. It finds out the bird, even when covered with the hand, and creeps unperceived again under the feathers. Many, that are thought to be killed when taken from the bird, fly back immediately. They leave the bird as soon as it is dead, as the head-louse leaves a human corpse. Cleanliness is the only remedy for this insect, and frequently sweeping and whitening the hen-house.

II. INSECTS WHICH INJURE GRAIN.

Gibbous Ground Beetle. — This is a beetle which injures wheat, rye, and barley. The eggs are laid together, and not singly, by the mother; and the larvæ are, apparently, three years before they undergo their transformation.

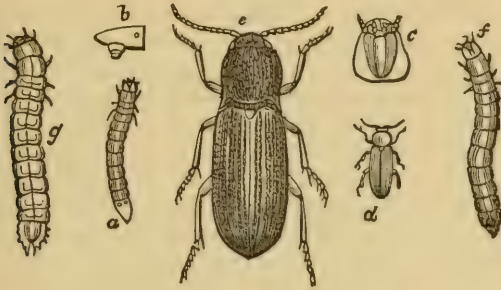
The length of the full-grown larva is rather more than an inch; it is flat, narrow, and nearly of equal width throughout, the head is very flatly pressed, armed with strong forceps, like jaws. To diminish their number, it is recommended to catch them by the hand, which may be done by children. The common net — a linen bag, stretched on a hoop of strong wire — may also be stretched at night on the corn, and the insects feeding on the ears be caught in it. In the day-time they must be looked for under stones and clods. In the autumn, when the first slight frosts set in, the farmer should plough those fields which have had crops of wheat, barley, and rye, as deeply as possible. Many larvæ which have by this time retired to their winter quarters will thus be turned up in a benumbed state, and will either be killed by the next frost or devoured by the crows and other birds in search of food. But this ploughing should be performed for many years successively, and by all the neighboring farmers simultaneously, or it will not be efficacious. Those fields which have been sown in autumn should be strewn with peat-ashes — when peat is to be had, and is used as fuel — in spring, when the supervening rains will disengage the sulphuric acid, which will kill the insects.

German or Field Cockchaffer. — An insect injurious to the ears of wheat and rye. It has a square abdomen, rather flat; its whole length is half an inch, and its breadth one fourth of an inch; the color of the wing-cases is mostly brown, but sometimes a small square spot is seen at their base, and another larger saddle-like spot of the same color in their middle; the head and thorax of a dark-green; the under side of the body and legs are black. These insects are found singly, or three or four together, sitting on the ears, and gnawing the still soft grains of rye, or of wheat. Crows, moles, and field-mice, are its greatest enemies. The perfect insect can only be diminished and destroyed by picking it off the plant. Children may be employed for this purpose, and must collect the insects in bags. The insects must be crushed or destroyed by putting hot water on them, and then given to the poultry, which will become very fat by feeding on them. The hand-picking must be early in the morning, while the dew is on the plants, as then the beetle hangs lazy and benumbed on the ears of corn.

Lined Click Beetle, — Larva, the Wire-worm. — A beetle particularly injurious to oats. The larva of this beetle — known under the name of the wire-worm — appears sometimes in great numbers, devastating corn by attacking the roots. This larva is slender and linear, flat, shining, smooth, slightly hairy, and brown. It resembles the meal-worm. The beetle is blackish, with gray hairs; the feelers and legs are brownish-yellow, and the wing-covers striped with gray. The best means of destroying them is to mow the oats, and plough up the ground frequently, when crows and

other birds will pick up the larvæ. In Fig. 352, *a* is the larva of *Elater segetis*; *b*, under side of the terminal segment of the body; *c*, the head seen from beneath; *d*, perfect insect, natural size; *e*, magnified; *f*, larva of the

Fig. 352.



true wire-worm; *g*, the larva of ditto, as described by some writers, being another species.

Winter or Dart Moth. — A moth that injures winter grain. The caterpillar or larva of a moth, which, from its food in the larva state, is called the winter corn-moth, is one of the most troublesome of the insect tribe. This caterpillar attacks both the leaves and the roots of the corn; also the roots of lettuce, turnips, and spinach. It appears generally in August, sitting quietly on the ground in the day-time, and flying about and pairing at night. When at rest, its wings are folded together flat over the body, and it is then nearly an inch long, and half an inch wide. Its colors are dirty-gray, and dark brown, or earth-color, except on the under wings, which are covered as it sits, and which are sometimes whitish-gray, sometimes cream-color. On the upper wings a faint, blackish, ringlike mark is seen, and a cone-shaped spot on a wavy line, a kidney-shaped stain almost in the middle, and towards the lower edge two other wavy or notched transverse lines. The most simple and certain mode of extirpating the noxious seed-eating caterpillar from the soil is, to repair to the fields, and collect the caterpillars as soon as they appear. The only question is, how the hand-picking is to be set about, without spending time unnecessarily. A person unacquainted with the habits of the creature would seek for it in vain in his fields. They lie in the day-time under stones, clods, or buried in the earth; these must therefore be carefully turned up, in search of the enemy. When they are changing their skins, they come out of their lurking-places, even in the day-time, and can easily be gathered. Immediately after sunset they come out in great numbers, and

feed greedily on the young corn. At this time, therefore, the work must be carried on vigorously, and even till late at night, with artificial light.

White-line Dart Moth. — A moth injurious to buckwheat and autumn-sown grain. The caterpillar is upwards of an inch long, and of the thickness of a slender writing-quill. On the back it is dirty olive-green, with a mixture of yellow. The head is brown; the abdomen and feet are dirty-yellow. It lives in the day-time in the earth, coming out only at night. The remedies proposed are — hand-picking, applying a strong dressing of lime to the land in the spring, strewing the ground with ashes, rolling the fields with heavy rollers, and lastly, driving flocks of sheep over the field.

Botys. — A moth, the caterpillar of which is injurious to millet. It is destroyed as follows: — As soon as the millet is reaped and carried away, let the stubble be pulled up, and burnt in a heap, with the caterpillars in it.

Corn Moth. — A moth injurious to grain laid up in magazines. The perfect insect or moth measures, from the head to the tips of the wings, from six to seven lines. The body is brown, with a little white on the back; the head has a thick tuft of whitish hairs; eyes black; upper wings more or less white, with brownish and dusky dots, varying in form and size. The most decided and certain mark is a spot of the same color at the base, followed by an almost square spot on the outer border; behind this, in a slanting direction, runs a band-shaped spot almost through the whole breadth of the wings. Behind this are two dots on the anterior border, and just above the tips of the wings a larger brown spot. The posterior border is furnished with long brown and white mottled fringes. The under wings are smaller and shorter, brownish, with long fringes at the posterior edge. This insect appears as a moth in May, June, and July, in buildings where grain is stored; it rests in the day-time, and only flies about at night, attacking rye, oats, barley, and wheat. The remedies proposed are — to fill up the cracks and holes, sprinkle the floor with a mixture of strong white-wine vinegar and salt before laying up the corn, sweeping the floor and walls thoroughly before stowage, and, if the moth has laid her eggs on the grain, common salt may be mixed with the grain. Other remedies are recommended, such as garlic, tobacco, wormwood, hemp, hops, elder-flowers, turpentine, and brimstone.

Corn Weevil. — A small insect, linear-shape, narrow rostrum, the elytra marked by impressed lines of dots. The female deposits her eggs upon corn in granaries, and the young larva at once burrows into the grain, of which it eats the interior. Various plans have been suggested for its destruction; perfect ventilation and a constant shifting of the grain are great preservatives.

Hessian Fly. — A small midge, injurious to wheat. Its body is covered with short black hairs; the thorax is much arched, smooth, and shining;

the *scutellum* projecting, rounded posteriorly; the breast sometimes golden-yellow; the abdomen brownish; the wings blackish; the golden-yellow of the base is sometimes continued to the veins, where it appears lighter, and disappears by degrees about the middle. The halteres are yellowish-white;

Fig. 353.

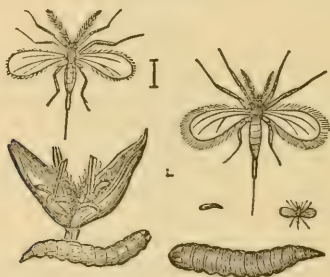


the legs golden-yellow at the base of the thigh. The female has a black streak on the abdomen. The larva is spindle-shaped, and whitish; the posterior end suddenly diminished; the head bent inwards, and transparent above. A short line is remarked within, which is the intestinal canal. It is dirty white below; in younger specimens this coloring appears like nine spots on each side, and has a row of still smaller spots in the middle. When the larvæ are fully grown, they unite in regular segments round the wheat; they are then provided with very small hooks or notches towards the head. Their length is three twentieths of an inch, and their breadth one twentieth. The perfect insect appears in June, and perhaps later; the female lays from one to eight eggs, in the autumn. The only practicable mode of destroying this insect is to wait till the grain is reaped, and then burn the stubble in which the pupæ lie concealed. If it should be impossible to do this, sow the fields next year with any other grain than wheat; better, perhaps, not to sow wheat anywhere near them, that the flies may not carry their eggs there.

Wheat Midge.—This is another small species of midge, injurious to wheat. When the wheat is in blossom, it is sometimes attacked by a small fly, of an orange-color, which lays its eggs in the middle of the blossom. When the eggs are hatched, the larvæ prevent the fructification of the grains, probably by eating the pollen. The perfect insect slightly resembles the common midge, but is smaller. The body is orange-yellow; the wings clear and transparent, and hairy at the edges; the eyes are black; the antennæ neck-lace-shaped, longer than the thorax, and the feet rather long. The smallness of this insect, both in its larva and perfect state, with the circumstance of the

destruction of the wheat when it is in blossom, allows of but little that can be effected by human aid. The safest and almost only certain means of

Fig. 354.



diminishing such an evil, for the next year, consists in not sowing wheat again on the same field, nor in its neighborhood. The larvæ quit the wheat in August, and pass the winter in the ground.

III. INSECTS INJURIOUS TO CULINARY VEGETABLES.

Spring Beetle or Skip-jack.—Gardeners remark, often to their great annoyance, that many newly-transplanted lettuces begin suddenly to wither and perish; this happens chiefly in spring and summer. If we seek for the cause, we find in the roots of the withering plants a worm, which is the larva of one of the Elateridæ, which much resembles the meal-worm. It eats, by degrees, the root of the lettuce as far as the collar from which the leaves are developed. It is light yellow, from six to seven lines long, of the thickness of a pigeon's quill; its body is cylindrical, somewhat flatly compressed at the head, rather pointed behind, with strong, black, and shining jaws. The pupa or nymph is shorter than the larva, paler in color, and thicker. The beetle, which is developed from the pupa in fourteen days, is from four to five lines long, one and a half lines broad, and has the usual form of spring beetles; it is slightly curved; head and thorax dark-brown; wing-cases yellowish, striped, with dots; the feelers are slender, notched, and yellowish-brown; the under side of the body also brownish. To get rid of this pest, pull up every plant that begins to wither, and kill the enemy within, or in the earth near the plant.

Asparagus Beetle.—There are two kinds. One is blackish-green, the thorax red with two black dots, yellow wing-cases, the suture and three spots united to it on both sides black; and the other, called the Twelve-spotted Leaf-beetle, is red, the wing-cases lighter, each having six black

dots; the horns, eyes, breast, edge of the abdomen, tips of the thighs and palpi, black. The first-named is called the asparagus beetle. The larva is spindle-shaped, flat beneath, arched, fleshy, wrinkled, covered with single hairs, bordered at the sides, of an olive-color; the head and legs black. The only remedy is to pick off and kill both beetles and larvæ.

Earth-flea Beetles. — This name is applied to several species of very small beetles, one of which is called the turnip-fly. They make great leaps, by means of their thick hind-legs; color generally shining-green, with a brown or yellowish hue. They attack cabbage, cauliflower, colewort, radish, cresses, flax, tobacco, hops, sainfoin, and summer and winter turnips. Shade, coolness, and rainy weather, are the surest protection of young plants from its attacks. The remedies are various. Pour boiling water on a handful of fresh or dry wormwood, and let it stand from twelve to twenty-four hours, to get cold; then put the plants that are to be planted out into the decoction, with their leaves downwards as far as the stem, so that their roots may not be wet, and then put into a cellar, or some cool place, and in six to ten hours afterwards, they may be planted without risk of attack. Young plants and seed-beds may also be sprinkled with this infusion. Plants may also be rescued, by applying road-dust after dew has fallen. These two modes of remedy are also applicable to field cultivation.

Mole Cricket, Churr Worm, Jarr Worm, Eve Churr, or Earth Crab. — This insect is very destructive to culinary vegetables, meadows, and corn-fields. When full-grown the mole cricket measures nearly two inches in length, and four lines in breadth. Its color is dark-brown; head oval, small and longish; two bristle-shaped and strong feelers; thorax covered with fine woolly hair; wings very broad and triangular, when expanded; abdomen soft; the two fore feet proportionally short, but broad and strong, adapted to dig in the earth. The surest and most efficacious remedy is to destroy the brood in June or July. First pour water into their holes, and then a few drops of any sort of oil; they leave their holes when they feel the water, and when touched by the oil, die immediately. Also, pits may be dug, two or three feet deep and a foot wide; after the frost, all the mole crickets will collect in these for shelter, when they may be destroyed in heaps.

Painted Field Bug. — A dangerous enemy to the cabbage tribe, particularly in dry summers, since in its larva, as well as in its perfect state, it pierces the leaves, till it makes them like a sieve. The perfect insect is about one fourth of an inch long, and only a little less broad, and rather flat. Its ground-color is red or white, its upper side spotted with dark-green; head dark-green, bordered at the sides with red or white before the eyes. On the wing-covers, or upper wings, the dark color prevails; they are bordered with red or white as far as the terminal third part; this border is

wavy, and has a green spot. The under side is reddish or whitish; the turned-up edge of the abdomen is marked with dark-green spots, also, on both sides. The larva has nearly the same markings, and only differs from the perfect insect by its want of wings. The only way to destroy these insects is to pick them off and kill them.

Plant Lice (Aphis). — These are especial enemies to various sorts of culinary vegetables. They, indeed, spare no plant; but they prefer juicy vegetables, — the different sorts of the cabbage tribe, peas, and beans. Ley and vapor of tobacco are recommended as the best means of killing the aphides, but these remedies cannot well be applied to culinary vegetables.

Large Cabbage White Butterfly. — The wings are white; upper wings with broad black tips, and the female has two black spots on the middle. The under side of the under wings is light-yellow. Appears from May to October. The caterpillar is bluish-green, thinly-haired, sprinkled with black dots, having a yellow stripe on the back, and some on the sides. Found on all sorts of cabbages, horse-radish, radishes, mustard, and similar plants, as well as on water-cresses. The pupæ are yellowish-green, with black dots, with a point on the head, and five on the back. The best way to destroy them is picking off and killing the caterpillars, as well as the pupæ, excepting those which have a brown appearance, as these are full of the larvæ of ichneumons, and other allied parasites, which are the great scourge of these caterpillars.

Small White Butterfly. — This resembles the former insect, but is smaller, and the black tint at the points of the upper wings is fainter, and not visible on the outer edge. The caterpillar is of a dull green, with very fine hairs, yellow stripe on the back, and yellow spots on the sides, on a pale ground. In some years, it is very injurious to the cabbage and turnip plants. The pupa is yellowish, or greenish-gray, with three yellow stripes. Destroyed in the same manner as the foregoing insect.

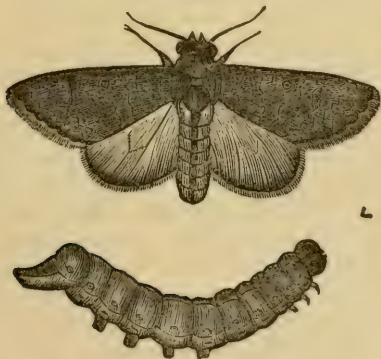
Green-veined White Butterfly. — The wings are white, with the tips of the upper ones black. The male has one black spot, the female two or three. The veins on the outer edge of the female's under wings are black. The under wings are yellow on the under side, with greenish-powdered veins. It flies about in April and July, and is of the size of the preceding. The caterpillar, which lives on the leaves of cabbages and turnips, is finely-haired, of a faint or brownish green, lighter at the sides, with reddish-yellow spiracles, small white warts, and black punctures. The pupa is yellowish-green, with points on the head, and its back is rather lighter than the foregoing species. Destroyed by the same means as the two preceding species.

Gamma Moth. — The caterpillar of this moth is so plentiful in some

years that it does great damage to vegetables, peas, and various sorts of fodder-herbage. The ground-color of this moth is light, and dark-gray, mixed with rust-color. The head and collar are of brownish-gray, edged with light-gray lines, as well as the crested back and shoulders. The abdomen is yellowish-gray, with elevated brown tufts of hair. The upper wings are marbled, and have a metallic lustre; the inner edge is wavy, and toothed near the fringes. The notched cross-lines are silvery; towards the inner border is a shining mark, resembling the Greek letter gamma; the under wings are yellowish-brown at the base above the fringes, with black bands. The blackish-brown pupa is inclosed in a white cocoon. The caterpillar is green, beset with single hairs, has twelve feet, and a brownish-green head. On the back are four very small yellowish or whitish lines; the feet have a yellow stripe. The spiracles are blackish-green. These caterpillars are found from spring to autumn, in a variety of generations. The only possible means of destroying them is by shaking them off and hand-picking.

Cabbage Moth. — The caterpillar of the cabbage moth is a great enemy to different sorts of culinary vegetables. The moth is of middling size, one inch and a half broad, when the wings are extended; its head, collar, and

Fig. 355.



back, are blackish-gray, intermixed with whitish and yellowish hairs. The back has a thick double crest; the abdomen is dark ash-gray, the upper half beset with black tufts in the middle. The upper wings are gray, with a mixture of yellow and white; the under wings are light gray, with dark veins, and central spots,—blackish towards the outer edge. The moth appears in May and June, sits in the day-time, and flies only at night. The

caterpillar is green, more or less covered with gray or black ; it has a dark stripe on the back, on which there is a pale, indistinct line. Above, it is sometimes furnished with dark or pale spots, placed lengthwise. At the sides is a dirty-yellow stripe, which becomes reddish above ; close above this spot are two white spiracles, surrounded with black, each in a small black spot. When this caterpillar is numerous, it does considerable damage to cabbages, lettuces, &c., by eating out the heart. It appears in July, August and September. To look for them and kill them is a troublesome, but the only sure way of getting rid of them.

White Line Brown-eyed Moth. — The caterpillar of this moth sometimes does a great deal of damage to different sorts of culinary plants, in the same manner as the moth last described. The moth is dark rusty brown ; the feelers have white scales ; abdomen ash-gray, with brown tufts ; feet grayish-brown, yellow-ringed below ; the fore wings have no connected cross-lines ; the round middle spot is surrounded with white ; the under wings are ochre-yellow, or dirty-white, with darker shades towards the whitish fringes. The reddish or yellowish brown caterpillar has on the back, and on each side, a dark stripe, and a whitish one nearly over the feet ; the under side and feet are light-brown ; it is dotted with black between the dark stripes. The pupa is shining reddish-brown, and remains in the earth during winter. Destroyed only by hand-picking.

Cabbage-garden Pebble Moth. — Of the family *Pyrilidæ*, a small group of moths, this species only deserves to be mentioned, as its caterpillar sometimes greatly injures several sorts of vegetables. The head, back, and upper wings of the moth, are hazel-brown, and brownish-gold ; the feelers light-brown ; the abdomen and under wings whitish. The first brood flies in May, and the second in August. The caterpillar is found in May and June, and the second generation in the fall. It has a light-brown head, and a yellowish-green body, with blackish stripes running lengthwise, and blackish dots, having fine white lines between. Its length is about two thirds of an inch. Destroy by shaking them off and burying immediately, or killing.

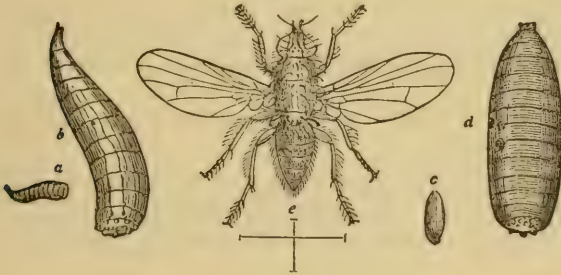
Carrot Moth. — The caterpillar of this small moth is a great enemy of carrots. The moth has a head and back reddish-brown, with single black atoms ; abdomen and feet ash-gray, the former with white incisions ; the upper wings are of a reddish-brown color ; there are also black streaks and white atoms, and fringes which surround an indistinct row of dots ; the under wings are of ash-gray, lightest nearer the base, with yellowish fringes ; on the under side, the upper wings are dark, the under wings light-gray. The caterpillar lives on carrots, and eats the flower and seeds. It is greenish-gray, inclining to yellow, strewed with black tubercles, emitting hairs ; the head and upper side of the thorax are brown. It attains the

length of half an inch. The means of its destruction are simply hand-picking.

Roesel's Tinea. — The little caterpillars of this moth sometimes do sensible injury to the choicest vegetables. The caterpillars are yellowish-green ; head shining blackish-brown. Look for them, and kill them.

Onion Fly. — The larva or maggot of a small fly, damaging the various sorts of onions. The perfect insect or fly is entirely of an ash-gray color in the female, or with black stripes on the back of the male, the wings clear like glass, with yellowish-brown veins. In the figure, *a* is the grub or larva ; *b*, magnified ; *c*, puparium, within which is the real pupa ; *d*,

Fig. 356.



magnified ; *e*, perfect insect magnified ; the cross-lines showing the natural size. The fly lays her eggs on the leaves of the onion, close to the earth ; the newly-hatched maggot bores through the first leaf, and then descends between the leaves into the onion to its base, when it entirely destroys the bulb, which soon becomes rotten. To destroy them, strew ashes and pounded charcoal ; also remove all the infested onions early out of the beds, before the flies are developed ; and these onions are easily known by their outward leaves turning yellow.

Cabbage Fly. — This is another small fly, which attacks the cabbage. The perfect insect is ash-gray ; the thorax has three indistinct black streaks on the back ; the wings are clear, like glass ; the abdomen is linear, with black stripes on the back of the male, or entirely ash-gray on the female ; the length is three lines. The larva much resembles that of the onion fly, but is thicker. The only way of diminishing this destructive fly is to pull up, and carry away betimes, the plants attacked by the larvæ, which may be known by their dull lead-color, and the withering of their leaves in the sunshine.

Lettuce Fly. — This fly is rather smaller than the former ; it is blackish

brown ; the under part and sides of the segments of the abdomen varying gray ; length nearly one fourth of an inch. It flies in July. The larva resembles the former, but is smaller and smoother, and its color varies more into yellow. It destroys lettuce-seeds, and other salad plants. It is almost impossible to get rid of these insects.

Negro Fly. — This insect, in its perfect state, is slightly haired, shining black, rather of a metallic-green ; head reddish-yellow ; legs light-yellow ; balancers white ; wings clear, like glass : one sixth of an inch long. The larva lives in the carrot, particularly near the extremity of the main root. The carrots die off by degrees, or at least lose their sweet taste, and become rusty, by the passages of the maggots. The larva of the carrot fly is cylindrical, pointed anteriorly, like parchment, shining, smooth, bare, pale-yellow. The only way to diminish their number is to pull up the sickly infested carrots, known by their yellow outer leaves and early withering, and to destroy the insects contained in them, before they change into pupæ.

IV. INSECTS INJURIOUS TO FRUITS, FRUIT-TREES, SHRUBS, AND VINES.

Black-veined White Butterfly, or Hawthorn Pontia. — This is a four-winged insect, which only flies by day, seeks its necessary food, and fulfils the work of propagation. It is large, wholly white, excepting that the ribs or veins

Fig. 357.



of the wings, and a short oblique stripe from the second to the third vein of the upper wings, are black, which distinguishes it from the cabbage butterfly. Eggs shining, yellow, cylindrical ; the newly-hatched caterpillars are dirty-yellow, and covered with hair : the head is black, and there is a black ring round the neck, and a brownish stripe on both sides. The first warm

unshine in spring, which causes the sap to flow, entices the caterpillars to leave their nest ; and as the blossom-buds begin to shoot, they are attacked and consumed, as are also the leaf-buds. At the second change of their skin, the caterpillars acquire two rows of yellow spots down the back, close to and between which extends a black line ; the back is covered with yellow and white hairs, and from the black stripes on the sides extend oblique ash-gray stripes, parallel to each other, to the upper side of the body. There is also a third change, when the caterpillars have a black stripe in the middle of the back, which extends to the posterior part of the body ; the yellow dots, to which the yellow hairs were attached, are not so perceptible, and the white hairs become more thinly scattered. The pupa is whitish-yellow, beset with black dots and stripes. At the beginning of June, the butterfly appears and propagates its species. The best way of destroying these caterpillars on low fruit-trees is by seeking out the eggs or young caterpillars, on the branches, and killing them. The hawthorn butterfly prefers the lower apple-tree, to lay her eggs on ; and they may be seen on the leaf, conspicuous from their shining yellow color, while the caterpillars are betrayed by their web, and the adjacent gnawed leaves. When there are no low trees, the high ones will be infested ; and in this case, the mode of destruction must be delayed till the leaves have fallen off, when the nests of the caterpillars will become visible. Lastly, a person provided with a butterfly-net can take the insect on the blossoms of plants and shrubs, on which it delights to sit in June, and suck the honey.

Yellow-tailed Moth.—This is a destructive insect in the orchard, the larvæ of the moth often infesting fruit-trees to such a degree that not a leaf or fruit remains uninjured. It flies about at night, and in the day-time sits quietly on a leaf, or on a wall, and suffers itself to be caught in the hand. The posterior part of the body is covered with a round mass of golden yellow hair ; its fore wings are dazzling white, as is also the greater part of its body, only the principal vein of the fore wing of the male is brown on its under side, and sometimes has a few black dots on its wings. The male has a smaller abdomen, a smaller tuft of hair on the tail, and strongly-teethed feelers or horns. The moth appears in June, and propagates, the eggs being lain on the under side of the leaf, covered with hair. The caterpillars are usually hatched in July ; they are dirty-yellow, black-headed, with a black ring round the neck, thickly-haired, and four rows of blackish dots on the back. They feed on the membrane of the leaf. They change their skins in August ; cease feeding in September, and become benumbed in November, passing the winter in their nest. Before the buds on the trees have begun to burst in spring, some of the caterpillars come out of their nests, and eat the unfolded leaves ; at the end of April, they change their

skins for the second time, and again in May, when they become reddish-brown, marked on both sides with white spots, as far as the extremity of the body, which is thickly set with hair along the back ; they now disperse over the different fruit-trees in the garden. To destroy them, the means are — the destruction of the eggs, killing the caterpillars soon after their birth ; collect the pupæ at a later period, pursue the moth in July and August, take their nests from the trees in autumn and spring, and seek out and destroy the half-grown caterpillars in their new webs in May.

Lackey, or Barred Tree Lackey Moth. — The caterpillar of this moth attacks all kinds of trees. The perfect insect is rarely seen, as it only flies at night, and conceals itself during the day. This moth is of the middle size ; the male, which is usually smaller than the female, measures, with spread wings, from tip to tip, from one to one and a fourth inches. The ground-color of the whole insect is either light-yellow, or reddish-yellow ochre ; the upper wings have always a darker band in the middle, which is bordered by two lighter cross-lines ; the fringes are whitish, and brown-spotted ; the under wings are always of a uniform color, light-yellow or brownish ; the horns are strongly toothed in the male, which has also a thinner abdomen. This moth usually appears in July. In spring, the caterpillars are developed about the first of May, and they live in society till the third molting. They are usually met with early in the morning, or on rainy days, at the forks of the twigs in a large nest, closely spun over with a silky substance and, when disturbed, they let themselves down by threads to the ground, and disperse. In the month of June, the caterpillar is fully grown ; it is often an inch in length, soft, thinly-haired, striped with blue, red, and yellow, — hence its fanciful name, — with a white line down the back ; the head is bluish-gray, marked with two black spots. To get rid of this insect, crush the whole colony, in May, with a stick, or sweep them down into a pot and destroy them. From the middle of June, and during July, search should be made for their cocoons, which will be found either fastened between two leaves, on trees or shrubs, or lying in the roofs of houses, on the tops of walls, or in hedges ; — tread on these cocoons. On low fruit-trees, the rings of eggs may be discovered, after some practice, when the leaves have fallen off ; and, when found, they must be removed from the tree and burnt.

Gypsy Moth. — Early in spring, before the leaves of the fruit-trees are fully out, the little caterpillars are hatched, and spread over the bursting buds ; the head is large yellow spotted ; six pair of red dots on the hinder part of the back ; tufts of hair on each side of the body, and single hairs on the back. After changing their skin, a pair of blue tubercles appear on the fore part of the back, — that is, on each of the first four figments of the body, by which they may be identified at once. Towards the end of June, the

caterpillars form their cocoons on the fruit-trees ; the moth appears in August ; the males are dark-brown, and their fore wings have three or four undulating blackish stripes ; the females are whitish-gray, their fore wings traversed by brownish stripes. The moth lays her eggs in various places in the fall. To get rid of these insects, first find out the egg masses, and crush them. As they are large, and usually in open places, we cannot avoid seeing them, if we look carefully, which should be done in autumn, or early in spring, before the caterpillars are hatched.

Goat Moth. — The caterpillar of this moth lives on the wood, instead of the foliage of the trees, thus materially injuring it. It is very large, smooth and shining, with here and there single hairs. It is dark-red on the back, also on the spiracles situated at both sides ; the sides and lower part of the body are flesh-colored ; the head is black, the first segment also marked with black above. It discharges a corrosive fluid at its persecutors, and also diffuses an extremely offensive smell. After remaining more than two years in the larva state, and casting its skin eight times, the caterpillar becomes of a light ochre-yellow hue shortly before pupation, which usually takes place in spring. The abdomen of the pupa is yellow, and the segments are deeply indented, and capable of much extension. The cocoon is situated immediately within the opening of the tree, so that the pupa, when matured, can press itself half out of the hole, when the shell bursts, and the moth comes forth usually in June or July. It is difficult to apply any remedies. When the existence of one of these creatures in a trunk is ascertained, by the extruded excrement, relief comes too late for the tree, even if the caterpillar may be killed ; still, the caterpillar should be reached, if possible, by enlarging the opening with a garden-knife, or endeavor to kill it by thrusting a piece of pointed wire up the hole of the tree.

Wood Leopard Moth. — This insect injures the trunks of trees in the same manner as the foregoing, to which it perfectly assimilates in its habits, and is destroyed by the same means. It is smaller, however ; is hatched in August, molts in September, and is full-grown the next June. From its first existence till its transformation, it is yellow, with raised, shiny black dots, on each of which there is a fine short hair ; there are two black spots on the head. The moth appears in August ; its ground-color is white, with scattered steel-blue dots ; it measures, with spread wings, two inches and a half.

Figure-of-8 Moth. — This insect feeds on the foliage of fruit-trees. In June, when almost full-grown, this caterpillar measures nearly two inches ; it is very juicy, of a yellowish-green color, with black tubercles ; it has a very small bluish head, with two black round spots on it. When young, it is lighter, and is often nearly white on the back ; but when old, becomes of

a bluish color. The pupa is small, cylindrical, reddish-brown, dull, in some degree powdered with blue; the moth appears in October, or in the following spring. The perfect insect or moth measures, with spread wings, from tip to tip, about one and three fourths inches. The whitish-yellow spot in the middle of the fore wings, which is divided by three incisions at the sides, and is situated between two blackish, undulated cross-lines, has been sometimes compared to the figure 8. A white wavy line forms a small white spot behind the second stripe at the anal angle; the toothed external edge has ash-gray, shining fringes, bounded with a line; the under wings, which are ash-gray, have a dull middle spot, and an indistinct band, with a small, black, streaky spot at the anal angle; the color of the feelers, which are toothed in the male, and filiform in the female, is rusty-brown; the thorax above is the same color as the fore wings, and the abdomen, with the extremity of the body, — which in the male has a tuft of hair, and in the female is cylindrical and downy, — is of the same color as the hinder wings. To destroy or diminish these insects, hand-pick them as soon as they appear. This is best done in rainy weather, when they take refuge under the branches and on dry places of the stem. Their presence can be detected by their rather elevated oval form, and they may be destroyed by the garden-knife, or a piece of wood.

Lunar Spotted Pinion Moth. — The caterpillars of this moth are rather thick and fleshy, light-green, with a whitish stripe along the back, and two darker lines along the sides; on the segments are whitish-yellow warts, furnished with fine, small hairs; over the feet and along the first three segments runs a yellow stripe, bordered with black. As soon as the fruit-trees are in leaf, this insect is on hand. They are fully grown about the first of June, and become pupæ of a blue, frosted appearance, on the trees themselves. In a few weeks the moth comes out; the fore-wings are brownish-red, with several undulating dark-brown transverse lines, and also have a whitish semi-circular spot, nearly at the tip; near to this, almost at the outer edge, is a rather large black spot; the under wings are light-gray, rather darker towards the fringes, which are yellow. To get rid of the insect, throw them down, by shaking the branches. The moths also usually fall from the tree, if the branches are struck in June and July.

Winter Moth. — The green-looped caterpillar produced by this moth is a ruinous insect to fruit-trees. It appears late in the autumn, and proceeds from a light-brown pupa, which lies from June to the end of October, either a few inches under the earth, or under stones and clods. The male is winged, — the female is almost wingless; the male is of a yellowish-gray, with pale-gray wings, traversed with delicate, darkish cross-lines; the female has a much thicker body, of an ash-gray color. It is a nocturnal

insect ; the eggs are laid singly, at the top of the tree, and are small and greenish. The caterpillars are hatched in spring, are at first gray, and

Fig. 358.



FEMALE.



then light-green ; black head, without ventral feet. They devour the leaves, buds, and fruit, and occasionally the trees do not recover for some time. The winter moths do not all appear in autumn, but many of them lay their eggs on the trees in the following spring. To prevent their attacks, it is recommended to surround the base of the stem with a wooden frame, or box, and daub it on the outside with tar ; others recommend the placing of a layer of bird-lime around the trunk of the tree, which is said to have equal effect, and does not require daily renewing.

Pale Brindled Beauty Moth. — It appears very early on the fruit-trees, — generally on the pear. The male is rather large ; the fore-wings are greenish-gray, covered with fine brownish dots, and traversed by interrupted gray cross-strips, interspersed with whitish spots between ; the hind-wings are more or less white, and through the middle of them runs a brownish wavy cross-stripe ; before the fringes is another gray, dark stripe ; the body of the male is also grayish-green, with long hairs ; the female is without wings, small, coffee-brown, with angular tufts of fine hair, and long feet, annulated with white and brown. In March, the female deposits her eggs on a small side-twig, in rows downwards, covering them with long gray hairs. As soon as the leaves begin to unfold on the twigs, the young caterpillars are hatched.

Lime Looper, or Mottled Umbre Moth. — Takes its name from the lime-tree, on which it likes to feed, as also on fruit-trees. This caterpillar, when full-grown, is of a reddish color, and has a yellow stripe on each side. It goes into the earth in May or June, and is transformed into a brownish-red pupa. The moth comes out of the earth in the beginning of November, and lays her eggs on a fruit-tree. The male is as large again as that of the winter moth; its broad fore wings are of a reddish-yellow, covered with blackish dots; the under wings are dirty-white, dotted with brown, and in the middle of the wings is a black dot. The female has no wings, is much larger than that of the winter moth; the head and body are whitish, covered with black streaks and dots, and the feet annulated with yellow and black. To guard against its ravages, the same contrivance as for the winter moth is to be resorted to, or strike the branches of the tree with a long pole in May, to throw down the caterpillars.

Small Ermine Moth. — This is a small, nocturnal, four-winged insect; the feet, feelers, abdomen, and fore wings, are white, — the latter covered with about twenty black dots; the under wings are blackish. The female lays her eggs, at the end of June or first of July, near a blossom-bud, or a leaf-bud. The caterpillars are hatched the same autumn, and as soon the next spring as the leaves of the apple-trees begin to be formed, these caterpillars take possession of them. The caterpillars mature about the middle of June, when they are dirty-yellow, or lead-color, with a black head; and on the side of each abdominal segment is a longish black spot, and near it small dots, each furnished with a hair. In June the moths are found on the fruit-trees. They may be taken from the tree by the hand, and destroyed.

Codling Moth. — A small, reddish-white grub, met with in early apples or pears. The fore wings have a light-gray ground, on which are scattered many delicate streaks of a dark hue, intermixed with others that are broad and cup-shaped. On the posterior border of the fore wings is a large reddish-brown spot, surrounded by a golden mark in the form of a horse-shoe. The hind wings are of a sparkling brownish-red, inclining to yellow, and are surrounded on the outer border by a broad, light fringe. The thorax and abdomen are of yellow and brownish-gray. This moth is to be seen in the evening, in May, on the apple and pear trees, busily depositing its eggs, either on the calyx, or in the hollow part of the fruit at the stalk end. In favorable weather, the little grubs are hatched in a few days, so that in May apples and pears are infested by them. At first the grub is white, with a black head and collar, and black, slanting double dots, which run in four rows from the head to the abdomen; it afterwards becomes more of a flesh-color, the head and collar turning brown, the dots gray and indistinct.

The little grub immediately becomes a pupa in the web, and in a few days the moth comes out, which shortly pairs, and deposits eggs on the fruit. To diminish this insect in some degree, collect the fallen apples every day, and take them out of the garden; also remove all fruit from the tree which has grubs in it, and clear the trees of all loose bark, before the middle of April.

Red Grub of the Plum. — Injurious to the early plums. It produces a moth; its fore wings are black, changing to a metallic hue in the sun; on the outer edge of the fore wings, and reaching up, there is the appearance of very fine silver dust; the black spot on the extreme point of the fore wings is surrounded with a white border, and has the appearance of an eye. This moth appears in June; the eggs are hatched when the weather becomes warm; in July, the grub penetrates deeply into the plum, and the outward wound, which it made in entering, soon heals up, and the plum becomes filled with the excrement of the caterpillar. There are few means in our power to destroy this insect. The tree must be shaken, and every plum which falls must be removed. Also remove the loose or split bark.

Red Bud Caterpillar. — The moth which proceeds from this is somewhat larger than the one above described, has a white, broad, transverse band, studded with gray spots, extending through the middle of the fore wings from one edge to the other, and occupies more than a third part of their whole surface; the other parts of the fore legs are gray. It is found on the fruit-trees in May; lays its eggs in June, which hatch the next spring, and attack the buds. A honey-drop is not unfrequently seen on the bud, which, issuing from the wound made by the insect, is evidence that it will expand no more; should no sap, however, issue from the wound, the bud will continue to grow, with the little caterpillar in it. The caterpillar attains its full size in four or five weeks; it then spins itself a white cocoon, in which it changes to a light-brown pupa, and appears again in May as a moth. To diminish the number of this insect, we must search for the caterpillar on the fresh flower-buds, taking it out with a penknife; if we search for all the closely-adhering leaf and flower buds on the dwarf trees, during the blossoming season, and separate them, no bud-eating caterpillars will escape
us

Plum tree Tortrix. — This larva, when fully grown, is about one fourth of an inch long, of a dirty-green color, with a red head, and is the caterpillar of a very small moth. It has three pairs of feet, and five pairs of fleshy prolegs. The body is sprinkled with a few small hairs. The larva lurks, during nearly the whole year, under the bark of the trees; the perfect insect appears first in June, and again in harvest. The female lays her

eggs on the outer bark, from which the young caterpillars, by degrees, penetrate to the inner bark. To prevent the moth from laying her eggs on the tree, or to prevent the caterpillars from entering the inner bark, wash the stem of the tree with a solution of lime, in June and September; also brush the tree, and when there is seen the smallest heap of red dust, introduce a needle, wire, or knife, into the opening, and destroy the larva. The moth, which, on account of its size and color, is difficult to be caught, is about half an inch long; fore wings dark-brown and yellow; silvery lines and yellow spots on the front edge; a dark-brown stain on the upper part of the wings, softened off at the edges, and surrounded by three red lines; the under hind wings are brown. The pupa is brown, and lies under the bark.

Copper-colored Weevil. — Among those insects which feed on fruits is the copper-colored weevil, *Curculio*, or *Rhynchites cupreus*. It is somewhat larger than the apple weevil, and its horny wing-cases are furrowed and metallic copper-colored. Its body and feet are of a somewhat deeper shade, and its proboscis and feelers are black. It appears in spring, on different fruit-trees; also called the plum-borer. When the plum is nearly the size of a large almond, the female weevil selects one in which to lay her eggs; and as soon as this is done, she cuts through the stalk with her proboscis, and by various cunning means causes the plum to drop off. The egg does not remain long dormant in the plum or the ground, for, if the weather is favorable, the larva is hatched in a few days, and it then proceeds to eat the pulp of the plum, which it does in about six weeks; and, being now fully grown, it buries itself in the earth, and awaits its transformation in the next spring, when it appears as a beetle, and again begins the work of regeneration. It is very difficult to catch these beetles on the trees, but much easier to destroy their young. Pick up the fallen plums, and frequently shake the trees, from June to July. However strong the wind may be, it seldom throws down healthy, half-grown plums.

Bacchus, or Purple Apple Weevil. — This beetle is of a purple and gold color, with dark blue proboscis, feelers, and tarsi. Its size is various. It is found early in spring on the apple-tree; begins the work of regeneration in midsummer, by boring a hole in the apple, laying an egg at the entrance, and pushing it inside with its proboscis, covering the hole in an ingenious manner; it proceeds in this way, depositing three or four eggs in different parts of one apple, and then leaves for another. The grub, which is whitish, with a black head, is hatched in a few days, and at once begins to eat the apple, and makes a passage to the surface, to throw out its excrement or admit more air. The larva is full-grown in three or four weeks, and, like the larva of all weevils, has no feet. It leaves the apple when ready

for transformation, conceals itself in the earth, and reappears the next spring as the weevil. To lessen their number, pick up and remove the injured pierced apples; also shake the trees well in June and July, to throw down the beetles and kill them.

Stem-boring Weevil. — This is a small beetle, entirely of a blue-steel, or a steel-green, shining, metallic color. As soon as the blossom and leaf buds begin to unfold, the beetle appears on the trees. The female selects a suitable part of the shoot, and bores to its middle; she then places herself over the entrance, lays an egg, pushes it into the proper place, and then, by piercing and cutting the shoot, causes it to fall; after this is done, she rests and feeds, and then bores another hole, if there be room, near the first, and lays another egg, and this operation is busily continued for some weeks. The egg in the shoot is hatched in about eight days, and a white grub, with a black head, then appears, feeding on the pith of the shoot; it is full-grown in a month, and then buries itself in the earth till spring, when it again appears as a steel-blue colored weevil; and when the tree begins to sprout, it gets upon it, and propagates its species. To diminish the number of these insects, look out for the full-grown insect, which is easily taken at the time of pairing, and is clearly seen by the splendid steel-blue color. Dexterity is necessary in capturing them. As we cannot, however, remove all of them, the shoots that lie on the ground, or which still hang on the tree, which have been attacked, must be collected and destroyed. Many of these kinds of beetles, about half the size of the one mentioned, lay their eggs in the pith of the petiole instead of the shoot; the female puncturing it to the right and left of the part where the egg is deposited, causing the leaf to wither and fall off; the grub then taking up its abode in the earth, and changing to a beetle. These leaves, which may be known by their rumpling up and becoming withered, ought to be taken off and destroyed as soon as possible.

Apple Weevil. — A small beetle; wing-cases dark-brown, with whitish-gray stripes; its rostrum, eyes, and under part of abdomen, black. It appears as soon as the sap is in motion in the trees in spring; and when the blossom-buds are pretty full of sap, the eggs are deposited, and the grubs are hatched, early or late in April, according to the weather. It bores a hole with its proboscis into the best blossom-buds; the female then fixes herself at the entrance, lays an egg, and pushes it into the hole; this operation is afterwards repeated on the same or on fresh buds; the grub or larva often comes out on the fifth or sixth day, and commences to devour the innermost parts of the blossom; but the blossom-bud continues to swell, and the petals to open, till it is almost expanded; but all at once its growth ceases, because not merely the blossom, — that is, the stamens and pistils of

the flower,—but the receptacle itself on which they stand, is devoured. The petals, therefore, which remain partially closed, forming a kind of cap,

Fig. 359.



wither by degrees, and at last appear scorched. To lessen the number of the apple weevils, remove all loose stones, and the leaves which fall in autumn; clear away the loose or broken bark; and on dwarf trees, take the pierced blossoms from the trees when the flower-cap begins to be formed, and before it appears burnt.

Pear Weevil. — While the apple weevil contents itself with only single blossoms of the apple-trees, this one attacks blossoms, blossom-buds, and

Fig. 360.



leaf-buds, together. If a pear-tree is examined at the time of blossoming, many buds will be seen to be brown at the points, and on nearer inspection, there will be found a dirty-white rugose maggot, with a dark-brown head, which in time is changed to a small weevil. Early in spring the female lays her eggs in the buds, causing them to become brown, and then to fall off when the insect is perfect. Should their attacks become too numerous, take off the pierced buds and burn them; also shake the trees early in spring, spreading a white cloth under the trees, so that the fallen insects may be seen; also bind strips of paper covered with tar around the stems, to prevent the beetles ascending.

Oblong Weevil. — This is one of a class of small, destructive beetles. It has a short rostrum; its head, thorax, and body, are black; its feelers and feet reddish, and its elytra furrowed, and reddish-brown or blackish. It appears early in spring, and selects the best leaves of fruit-trees. They pair in spring; in June, the female lays her eggs in the earth, and the grub

that is produced feeds on the roots of plants, passes the winter in the earth, and, in the spring, appears transformed into a beetle. They should be watched in the spring, and, with caution, may then be caught by the hand.

Red-footed Beetle. — Another small insect, feeding on the leaves of fruit-trees. It is shining black throughout, except its red feet; the tips of the feelers are black, and the basal part reddish. It appears generally in May, and continues a long while. It may be caught by the hand.

Garden Beetle. — The *Melolontha* (or *Anisoplia*) *horticola* is another leaf-eating beetle. It is larger than the oblong weevil; its wing-cases are red-brown, but somewhat shining, and not reaching to the extreme point of the body. Its body, thorax, and head, are dark-green; its feelers reddish, with a dark-green, strongly-cleft terminal club. They appear somewhat later than the one just mentioned. The female lays her eggs in the earth, and the larvæ, when hatched, feed on the roots of plants, are transformed to beetles, and appear again as such in the spring. It feeds on the leaves of fruit-trees, and is particularly injurious to the apples, because it feeds on them when they are very small. When numerous, they often gnaw all the leaves till they resemble a sieve, thus checking the growth of the tree, and causing the fruit to fall. As these insects are tolerably large, they are easily seen, and can be removed with comparatively little difficulty.

Apple-bark Beetle. — So called because it prefers the apple-tree in which to deposit its eggs. It is small; head and thorax black; the extremity of the palpi and feelers reddish; the longish wing-cases blackish, and somewhat hairy; the feet dilated, and of a reddish-yellow; the thighs black. When the female finds a suitable place, she bores a completely round hole in the tree, penetrating to the centre, the minute particles of wood thrown out serving as a sign of the insect's presence. At the end of the entrance, snow-white, longish eggs are laid, which are also the characteristics of the larvæ that are hatched in May. The larvæ grow very rapidly. This variety of insect belongs to a tribe of beetles whose economy is well known, and in which the larvæ of all the species whose habits have hitherto been noticed burrow beneath the bark, devour the soft inner bark, or wood beneath the bark, and form distinct channels, diverging from the place where the eggs were deposited. The only way to destroy them is to cut off the branches infested with their eggs; and should the trunk be also attacked, the whole tree had better be cut down and conveyed away.

Small-bark Beetle. — This beetle is the *Scolytus hæorrhous*. It is black, the ends of the wing-cases generally reddish; the feet brownish-red, and the wing-cases furrowed lengthwise, and distinctly spotted. They make small holes in the stem, penetrating deep into the bark. It is evident, that when any tree is attacked by this insect in great numbers, it must

perish, because no tree can continue to grow with an injured bark and pierced sapwood. The insects cannot easily be eradicated, or, at least, diminished in numbers, but by removing the trees attacked by them.

Common Elm-destroying Scolytus.—An insect allied to the apple-tree scolytus, committing ravages on fruit and other trees. The perfect insect or beetle is small, cylindrically formed, and tolerably firm to the touch. The head and thorax form the principal part of its body. They are black and shining, finely and thickly dotted, the former covered with short yellowish-gray hairs; the feelers are light pitch-brown, ending in a knob; the wing-cases are, as it were, obliquely cut off behind, and at the base near the thorax somewhat hollowed, — are marked in lines which are dotted, as are also the spaces between them, — their color is pitch-brown; the abdomen, from the base to the apex, is as if slantingly lopped off, and, like the thorax, of a dark pitch-brown, thickly dotted; the legs are reddish-brown, with the second joint tolerably broad. The larva is yellowish-white, with a large shining head, a brown mouth, and a whitish-transparent swelling between the head and the first ring on the throat. They confine themselves to the inner bark, destroying that part by degrees, and causing the tree, or some of its branches, to perish. The only remedy is to fell and carry off the trees attacked, and burn them, in the autumn, in winter, or in early spring, at the time when the insect is still in the larva state.

Plum Saw-fly.—The green gage and round plums are sometimes attacked, when hardly the size of a pea, causing them to fall off, by a saw-fly, which makes use of the pulp as food for her offspring. It resembles the house-fly, but has four wings; the head and body are black, and the feet reddish-yellow. As soon as the blossom-buds begin to expand, the insect appears, pairs, and then begins to lay its eggs, — selecting the largest kinds of plums, — in the upper part of the green envelope of the blossom, cutting in and piercing it through, and immediately introduces the egg into the deepest part. The egg is small, and is hatched in a few days, appearing a delicate whitish larva, with a dark-brown head, six pairs of middle feet, three pairs of fore feet, and one pair of anal feet. It fixes itself in the centre of the plum-stone, which it eats; in six weeks it is fully grown, and the plum then drops to the ground, the insect buries itself in the earth till the next spring, when it appears again as a perfect saw-fly, ascends the plum-tree, and continues its species. To diminish the number of this insect, take the plums infested by the larva from the tree, and destroy them; — these are known by a small black opening in the plum; — also pick up and convey away all the plums that fall.

Pear Saw-fly.—This insect attacks the pear-tree to lodge her young there. It measures, from the front of the head to the extreme point of the

body, $\frac{1}{3}$ of an inch and one sixth in breadth. Its long feelers consist of numerous joints, the basal part of which is very thick and long, the second much thinner and shorter, and the third the longest. The head is black, with a yellow triangular spot between the feelers; the breast and the upper side of the thorax are quite black; the first abdominal segment likewise black, but surrounded with yellow; the other segments are orange-yellow from the plates to the two edges, by which the upper part of the abdomen is united to the belly; these plates are of a light-yellow color; the wings look glossy, with a dark-brown mark round the edge, and an obscure kind of stripe, which extends across the whole breadth; the three pairs of feet are of an orange-color. It appears in May and June; the eggs are laid on the under side of the leaf; and the caterpillar, which is hatched in a few days, is first whitish-yellow, but becomes darker every day. It has a black head, and just under the throat are two black dots; the other parts of the body are ochre-colored, and transparent, without hairs. In five weeks they are full-grown; then leave the tree, bury themselves in the earth, and do not appear again as saw-flies, till the next spring, to propagate their species. Their webs must be removed from the trees.

Peach or Poplar Saw-fly. — To those insects which only attack the leaves of fruit-trees, and use them as food, belongs the peach saw-fly. It is a little longer than the common house-fly, is black, and only on the hinder part of the body, the back and the abdomen, are seen whitish square incisions, extending on both sides towards the middle; the feelers are simply jointed, the palpi and feet are yellow, the thighs black. They appear in April or May, laying their eggs firmly on a leaf, a white-greenish grub being produced in a few days, which eats the leaves; they are full-grown in five or six weeks, are about the size of the green lopper of the winter moth, of a light-green color, with black heads, three pairs of fore and one pair of hind feet; they now retire into the ground, remaining there till spring, when they again appear as saw-flies to propagate their species. The larvæ is very destructive, the trees looking as though covered with spiders' webs, instead of leaves. Examine the trees carefully when the leaves are expanded, and the pale-yellow eggs, which usually lie together on the point or edge of the leaf, are easily seen. If these are destroyed as soon as they are laid, the leaves will not be consumed. The green larvæ cannot escape notice, as they are always surrounded with a web, and rolled up in the leaves they have gnawed.

Pear Chermes. — These creatures beset the young shoots and bearing wood of dwarf pear-trees. It is an insect nearly allied to the plant-lice (*aphides*). It has wings, and is about the size of a large aphid. It has a broad head, terminating in front in two cones; but there is no opening for

the mouth in the head, it being situated in the middle of the breast. The rostrum stands out perpendicularly, and ends in a point, from the latter

Fig. 361.



issuing the very long delicate tongue with which it sucks its food. The female is mostly crimson-colored; the male in some parts more shaded with black; the wings of both are membranous and snow-white. As soon as the buds appear, the winged chermes appears, and the eggs, which are longish and yellow, are deposited on the young leaves and blossoms, or on the newly-formed fruits and shoots. They are hatched in a few days, and resemble the apterous plant-lice, have six feet, and are dark-yellow. After a few days, they change their skins, and become darker; and when they have molted for the last time, and have attained full size, the body swells gradually and becomes cylindrical. They then leave their associates, and, before they lay aside their nymph-like covering, they fasten themselves firmly to a leaf; after a few minutes the skin splits on the upper part of the covering, and a winged insect proceeds from it, of a pleasant green color, red eyes, and snow-white wings. After a few days, this chermes has assumed the colors of the perfect insect; the head, collar, and thorax, are of an orange-color, and only the abdomen retains its green hue. Late in the autumn it selects a place for protection from the cold, and in spring appears in its crimson black-shaded clothing, to begin the work of regeneration. To clear the trees from them, brush the young off with a stiff brush, and tread upon them; or, search out and take away the winged chermes from the dwarf pear-trees, as soon as the blossoms appear and the shoots begin to grow. Their red color and long wings discover them, and as they are not shy, they are easily caught by the hand.

Apple Chermes. — The eggs are laid in September, on different places of the twigs of an apple-tree, usually, however, in the furrows of the knots. In the formation of the body of the perfect insect, it exactly resembles the pear chermes; it is, however, different from that species in color, the eyes, instead of being red, are of a snowy-white, with a black pupil; the back of

the thorax is of a light-green, the abdomen is marked with yellow rings, and the membranous wings with strongly-marked snow-white veins. The snout, which contains the setiform tongue, is situated, like that of all the species of chermes, in the middle of the breast. When very numerous, these insects cause considerable destruction; because, when all the single standing blossoms are completely covered with blisters, broken filaments, and small hairs, as is usually the case, and the flower-buds have been weakened by the previous sucking of these insects, no fruit can be produced. To secure the blossom and fruit of trees in pots, or dwarf trees, brush away the young chermes with a fine brush, when they appear, or at latest when the first changing of the skin takes place in April. It is also necessary to examine the small apple-trees in spring, when the blossoms begin to appear, to ascertain if any aphides are upon them, and if so, to destroy them.

Plant-louse, or Aphis.—There are particularly three species of aphides which are very destructive to fruit-trees, namely, the apple, plum, and peach aphides, *Aphis pyri mali*, *Aphis pruni*, and *Aphis persicæ*. The apple aphis is grass-green, the plum aphis light-green, and the peach aphis dark-green. The old females are known by dark-brown spots on their bodies. They all

Fig. 362.



appear as soon as the fruit-trees leaf. The peach aphides appear the first, and are seen upon the trees when the buds are very young; they proceed from eggs which were laid on the shoots the previous autumn, and are only females without wings. No sooner do they see the light than they disperse over the leaves and shoots near them, and begin to suck out the sap. In twelve days they are fully formed, and at once produce young. The offspring of the second generation is, if the weather be warm, again ready to bring forth in ten days, at the latest. It often happens that sixteen generations in all are produced,—some of the progeny having wings, and others

none ; the latter never leaving the tree unless driven by force, and the former pairing and producing their young wherever it may suit them. In September, males and females are produced from the last generation ; the apple aphid producing males which do not obtain wings, and the peach aphid those that do. When these newly-born males and females are full-grown, pairing takes place. The females then no longer produce living young ones, but lay eggs, from which the mothers of the forthcoming generations proceed. They lay their eggs on the twig or shoot itself, and either all around it, like the apple aphid, or on or near the buds, like the plum and peach aphides ; the females, having thus provided for their future spring progeny, die off in the autumn ; the eggs survive the winter. With regard to the apple aphid, there is no method more effective than destroying the eggs soon after they are laid. They may be seen late in the autumn, or early in spring, on the dwarf apple and pear trees, especially the young trees that have high stems, because the eggs lie exposed close together on the shoots, like grains of gunpowder, and yield a green juice, if pressed. We should not, however, press them, but the shoots should be washed over with liquid loam, garden earth, or whitewash, which will kill the eggs. With regard to the plum and peach aphides, we must wait till they are hatched and sitting on the leaves or blossom-buds, when, being of a dark-brown, they are easily seen. When the peach-trees begin to put out their leaves, examine them thoroughly on account of the aphides, because, at a later period, when they are numerous, the trees cannot easily be freed from them. Prune off the shoots infested by the aphides, and brush the tree, carefully examining every tree in June, July, and August, because the third and following generations bring many into the world, that soon obtain wings and disperse themselves.

Small and Large Pear Midges. — This species of midge is very small ; the feelers are cylindrical, finely-haired, and composed of sixteen joints, with the two basal-joints thicker than the others ; the abdomen is slender, seven-ringed, and finely-haired ; there is a knobby two-jointed pair of forceps on the extreme point of the body of the male, and the same part of the female is pointed ; the wings lie in a parallel direction ; the feet are long, thin, and finely-haired. According to some, it is a species belonging to the genus *Sciara* ; others call it *Molobrus*. The small pear midge lays her eggs in the blossoms when they are still closed. The large pear midge, female, is little more than one twelfth of an inch long, and half as thick ; the male is more slender, and shorter. The feelers are blackish, and not so long as the body ; the head is black and shining, as is also the thorax ; the proboscis ash-gray ; the abdomen of the male a deep black, — that of the female browner, with black rings ; and the anal point is quite black ; the feet are ash-gray, the tarsi and wings black.

The pears infested by these insects will, on being opened, be found with the core eaten out and empty, or half rotten, causing the fruit to fall to the ground, while some will be found but little decayed, though containing several yellowish larvæ, one twelfth of an inch long, and a third as thick, with ten segments without feet; and each having a pointed head, on which two black spots stand close together.

Black Gall Midge. — There are a number of species of this insect. The thorax is black, varying to ash-gray backwards, with black lines on the back; the scutellum is grayish; the abdomen blackish, with yellow incisions; the feet are of a pale-gray, and the feelers are blackish-brown. They are found to lay their eggs in the blossom of the pear-tree, as soon as the buds are so far developed that in the single blossoms a petal is seen between the segments of the calyx. It fixes itself almost perpendicularly in the middle of a single blossom, and, piercing the petal through, the eggs are laid on the anther of the still-closed blossom. The eggs are hatched in a few days, and the small larvæ bore into the blossom, in or near the stem of the calyx. When they have consumed the pulp of the small fruit, they are full-grown, and then they leave the tree, to bury themselves in the ground, or else remain in the core till the pear falls to the ground. They issue from the earth in spring, to propagate their species.

Paradoxical Pear Platygaster. — This is a small insect, said to have the male organs of generation on the under side of the thorax, and those of the female at the extremity of the horn arising from the base of the abdomen, and curved over the head. As it is generally thought to be simply parasitical upon other insects, we shall not describe it further.

Rhynchites (Curculio) Betuleti. — *Rhynchites Bacchus*, Sch., has hitherto been considered as the peculiar enemy of the vine; it is, however, never found on vines, but only on other kinds of fruit-trees, and is essentially distinguished from the *Rh. Betuleti* by its shining copper-color. The latter insect is a small weevil, of a metallic-green or steel-blue color. It is one third of an inch long, including the rostrum, — the latter being nearly a third of the whole length; it is tolerably broad, and turned downwards. On the thorax of the male, towards the front on both sides, are observed short spines; the abdomen is almost quadrangular. The spines are wanting on the thorax of the female, and her rostrum is shorter. The beetle appears in spring, as soon as the trees are in full foliage, and begins its work of destruction in May. It makes use of the leaf of the vine partly for a dwelling, and partly for the food of its young. When the female has selected a suitable leaf, she cuts the petiole with her rostrum almost half through, so that it hangs down. She then begins to roll the leaf together, generally alone, but sometimes assisted by the male. While this operation is going forward, she also lays her eggs;

that is, she pierces the roll, lays an egg in the opening, and pushes it in with her rostrum in such a manner that it remains on the inner surface of the leaf. When she has thus introduced five or six eggs, between the different folds, she rolls the remaining part of the leaf entirely together, so that it is impossible to discover, from the outward appearance, in what manner the eggs were deposited. This beetle also finds the leaves of the pear-tree suitable for its purpose, rolling up the leaves of the leaf-buds. In a few days the eggs are hatched in the rolls, and a whitish small worm comes out of each egg, with black oblique stripes over the back, and a reddish head. In four or five weeks it is fully grown. In the mean time, the petiole and the roll have become so dry that they are easily torn off by a moderately high wind, and fall to the earth. If this does not take place till the worm is fully grown, it leaves the partly-consumed roll, buries itself in the earth, and appears again in spring as a weevil. This beetle, therefore, is the real weevil of the vine, defoliating it, and preventing the grapes from ripening. As it is tolerably large, it may easily be perceived, and may consequently be destroyed, particularly as it allows itself to be taken without flying away. When it is numerous in orchards, it should be taken off, and the leaf-rolls pulled off, and burnt or crushed.

Vine Scale Insect. — This insect forms a longish, marbled-brown scale. In old age the scale becomes blackish-brown, hemispherical and wrinkled. The eggs, which are laid under the body of the female, are covered with long white wool. They are found on vines, particularly in gardens. Their destruction is best effected by dry-brushing in autumn or spring

Fig. 363.



Vine Beetle. — It issues from the earth in spring when the vine has begun to shoot, creeps upon the branches, bites off the leaf and flower buds. The largest male specimens are little more than two thirds of an inch long, and half an inch broad, black and shining; head large; thorax broad; abdomen short; legs rather strong. To protect the vine, the only way is to collect and kill the beetle, which carries on its evil practices in open day, and is discernible on account of its form and size.

Vine Saw-fly. — The saw-fly of the vine is of a jet-black color, except the upper side of the thorax, which is red, and the fore legs and under side of the other legs, which are pale-yellow or whitish. The wings are semi-transparent, smoky-color, with dark-brown veins. The body of the female is one fourth of an inch in length; that of the male is somewhat shorter. These flies rise from the ground in the spring, and lay their eggs on the lower side of the terminal leaves of the vine. In the month of July the false caterpillars, hatched from these eggs, may be seen on the leaves, in little swarms. Beginning at the edge, they eat the whole of the leaf to the stalk, and thus proceed from leaf to leaf, till they have grown to their full size. They then average five eighths of an inch in length; have twenty-two legs; the head and the tip of the tail are black; the body, above, is light-green, paler before and behind, — the lower side of the body is yellowish. As a remedy, it is recommended to strew air-slacked lime upon them, and also upon the ground under the vines.

Canker Worm. — This insect is most abundant on apple and elm trees: but cherry, plum, and lime trees, as well as some others, and many shrubs, suffer from them. The leaves first attacked will be found pierced with small holes; these become larger and more irregular when the worms increase in size, and, at last, the latter eat nearly all the pulpy parts of the leaves. There is a great difference of color even among the same species, of the same age and size. When very young, they have two minute warts on the top of the last ring; and they are then generally of a blackish or dusky-brown color, with a yellowish stripe on each side of the body; there are two whitish bands across the head, and the belly is also whitish. When fully grown, they become ash-colored on the back, and black on the sides, below which the pale-yellowish line remains. Some are found of a dull greenish-yellow, and others of a clay-color, with slender blackish lines on the sides, and small black spots on the back. When not eating, they remain stretched out at full length, and resting on their fore and hind legs, beneath the leaves. They leave off eating when about four weeks old, and begin to quit the trees. After reaching the ground, they immediately burrow in the earth, to the depth of from two to six inches, and they are there transformed. To prevent the ravages of this worm, one method is to bar the ascent of the

wingless female up the stem of the tree. This is done by taking two pretty wide pieces of board; plane them; make semi-circular notches in each, fitting them to the stem or body of the tree, and fasten them together securely at the ends. The crevices between the boards and the tree may be easily stopped with rags or tow; then smear the under side of the boards with tar. The tar, being defended from the direct rays of the sun, will hold its tenacity longer, and therefore need not be frequently renewed. The trees, in this way, will be less liable to be injured by the drippings of the tar, by leaving a margin of two or three inches on those parts of the boards which are next to the trees, to which no tar is applied. Another mode of intercepting the insect's path is to enclose the trees with collars, or circular slips of tin or zinc. And still another mode — though these are only three out of nearly a hundred that are practised — is, to dig around the trees, and lay the earth smooth; then take air-slacked lime, and strew an inch thick around the trees, to the extent of two or three feet from the roots; then tar the trees.

Apple-tree Borer. — They are the larvæ of a beetle called *Saperda bivittata*, — the two-striped or the brown and white striped *Saperda*. This beetle varies in length from a little more than one half to three fourths of an inch. It comes forth from the trunks of the trees, in its perfected state, early in June, making its escape in the night, during which time only it uses its ample wings in going from tree to tree in search of companions and food. The trees and shrubs principally attacked by this borer are the apple-tree, the quince, mountain-ash, hawthorn and other thorn-bushes. The larvæ are fleshy whitish grubs, nearly cylindrical; the head is small, horny, and brown; the first ring is much larger than the others; the next two are very short, and, with the first, are covered with punctures and minute hairs; the following rings, to the tenth inclusive, are each furnished, on the upper and under side, with two fleshy warts, close together; the eleventh and twelfth rings are very short; no appearance of legs; the grub cuts a cylindrical passage through the bark, and pushes its castings backwards out of the hole, from time to time, while it bores upwards into the wood. The larva state continues two or three years, during which the borer will be found to have penetrated eight or ten inches upwards in the trunk of the tree, its burrow at the end approaching to, and being covered only by, the bark. Here its transformation takes place. The pupa does not differ much from other pupæ of beetles; but it has a transverse row of minute prickles on each of the rings of the back, and several at the tip of the abdomen. The final change occurs about the first of June, soon after which, the beetle gnaws through the bark that covers the end of its burrow, and comes out of its place of confinement

in the night. Killing it by a wire thrust into the holes it has made, is one of the oldest, safest and most successful methods.

V. INSECTS INJURIOUS TO FLOWER-PLANTS.

Earwig. — This well-known insect, considered, without cause, as very dangerous to mankind, must find a place among those chiefly injurious to fruit and flowers. Its size varies according to its age and sex. When fully grown it measures almost an inch, including the forcep-like appendage at the end of the abdomen; its breadth is one sixth of an inch. The body is light-brown, free from hair; it has very short wing-cases, under which the wings lie concealed, folded both longitudinally and transversely. It is usually under the bark of trees, in the hollow stems of trees, in rolled-up leaves, and under stones. In orchards, it particularly injures the fruit of trees which are trained as espaliers, such as peaches and apricots, which are often entirely pierced through in warm weather. They also attack the other sorts of fruits, particularly apples and pears. In flower-gardens they destroy carnations, pinks, and dahlias, in particular. The only certain method of destroying earwigs is by catching them, which is best effected by hollow tubes, laid here and there, in orchards and flower-gardens. The common reed is fit for this purpose, but the hollow stem of the sunflower is even more so, as the insects are eager in the pursuit of the remains of the sweet pith. They are also easily caught between the folds of paper, or in pieces of cloth and linen laid on the ground. They creep into these traps in the morning after their nocturnal rambles, and may easily be shaken out and killed at any time of the day. Some place the flower-stands in vessels of water, which prevents the earwigs from creeping, but not from flying, upon the plants.

Orange Scale Insect. — It appears like an elliptical nut-brown shield, and is very plentiful on green-house plants, particularly on orange-trees, fastening itself upon the branches and leaves, particularly when the trees are kept rather warm. It is best destroyed by washing the branches and leaves. If this be done in autumn, it is a great advantage, as the old ones cannot creep up again.

Mealy Bug. — This species is reddish, and strewed with white dust. At the sides of the twelve segments of the body it is provided with small tubercles. The male is slender and gnat-like, with two rather broad wings, and two long, brush-shaped tail filaments. It attacks a number of species of plants, and can only be diminished in number by brushing them off carefully with soft brushes, and crushing them.

Oleander Scale Insect. — The female appears as a yellowish, round, flat shield, almost destitute of limbs, which sucks plants with its rostrum. The shield of the male larva is smaller than that of the female, and quite white-

The perfect male is brownish-yellow, dusted with white, and white wings. Length, one thirty-sixth of an inch. It lives in amazing numbers on different kinds of plants, particularly on oleanders, acacias, aloes, palms, &c., and can only be gotten rid of by careful brushings.

Rose Scale. — The female is like that of the former. The male pupa is linear, doubly furrowed on the back. The perfect male is pale-red, dusted with white, and white wings. Length, one thirty-sixth of an inch. They live on the stems and old twigs of rose-trees, which are sometimes entirely covered with them, and look mouldy. The best way of getting rid of them is brushing them off with strong brushes before the rose-trees sprout. Rose-trees are much injured by these insects.

Cactus Scale. — The female bears a great resemblance to the oleander scale, only that the muscle-shaped shield is more oblong and darker. The male is orange-yellow, the pupa linear, doubly furrowed, powdery-gray. Lives principally on the different species of cactus.

Sweet Bay Scale. — The shield of the female is oval-shaped, brown, with a reddish-yellow elevation before. The male is pale cherry-red; the body flat; the horns or feelers rather shorter than the body. The shield of the larva the same as the female, but narrower. It is difficult to remove, as it is so firmly seated that brushing is not always sufficient; a pointed stick must therefore be had recourse to.

Rose Moth. — In early spring, as soon as the rose-tree begins to bud, a very dangerous enemy to the growth of its leaves and blossoms arrives. It is the more to be dreaded, as, from its smallness and peculiarity of form, it is easily overlooked. If the new leaf-shoots are closely examined, a little brownish scale is found here and there attached to them; and upon nearer inspection, we shall be convinced that it is a little case, in which a worm, the larva of a small moth, is concealed, which gnaws the tender shoots. When it has devoured one shoot, it removes with its house, and attacks another; and thus, in a short time, one of these larvæ can strip a whole branch of its shoots. The larva which lies in the little case is about half an inch long; yellow, with a black head, and black-spotted collar. It undergoes pupation in its case, which enlarges from time to time, as necessity requires. The moth appears at the end of May. The whole body is silvery shining gray; the upper wings strewed with minute black dots, deeply fringed at the posterior edge; the under wings are narrow, pointed, with very long fringes. The only certain way of preserving rose-trees from this enemy is to look for the small cases in early spring, before the foliage is developed, when an experienced eye will easily discover them. They must be crushed immediately.

Plant Mite, or Red Spider. — A small insect of the spider class. It is

scarcely visible to the naked eye ; has eight legs ; its color changes from yellowish to brown and reddish, and on each side of the back is a blackish spot. In the open air it usually attacks kidney-beans. Among trees, the young limes mostly suffer, and the mites are found in thousands on the under-side of the leaves. These leaves assume a dirty-yellow or brownish appearance, and in the middle of summer the trees acquire an autumnal hue. Frequently sprinkling the plants with cold water has been found efficient as a means of destroying these insects. Also repeatedly fumigating the hot-houses with strong tobacco-smoke injures them in some degree.

VI. INSECTS INJURIOUS TO MEADOWS.

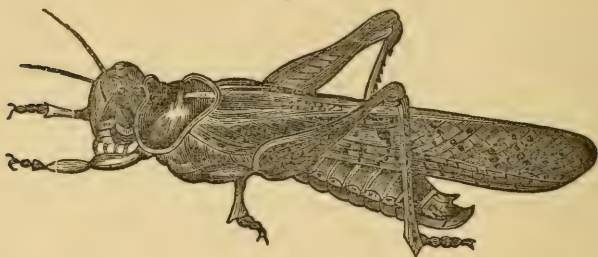
GENERAL REMARKS. — Most of the insects that choose the various sorts of corn for their food do not reject the other sorts of grasses, in the meadows. The herbage of the meadows suffers from the roots of the grass-plants being injured, which is chiefly occasioned by the larvæ of various species of cockchafers living in the earth. When bare spots are seen on meadows, we may be sure that the larvæ of the cockchaffer are there carrying on their work of destruction. But the large swarms of those smaller species of cockchafers sometimes seen flying about, towards evening, in the meadows, in the spring, and at the beginning of summer, and the round holes which we frequently find in meadows, through which they had crept out of the earth clearly show that they had passed the first period of their life there, and at the expense of the herbage.

Unspotted Lady-bird. — An insect injurious to many of the artificial grasses. It has been observed on the common tare, sanfoin, and the different sorts of clover. This larva is only one sixth of an inch long, yellowish-white, with single green spots, and the upper side of the body covered with prickles. Its transformation takes place on the leaves. The pupa is light-yellow, covered with minute hairs of the same color. The perfect insect is almost globular, yellowish-red on the upper side, with a brownish-red spot on the thorax. The abdomen is brownish-black, and the legs reddish, or reddish-brown. A good soil and moist weather, which will cause the herbage to grow quickly and luxuriantly, and to be often mown, are the chief requisites for diminishing the insect. By often removing the cut fodder from the field, the insect will be disturbed in its propagation.

Migratory Locust. — An insect destructive to all vegetation. Their native country is in the plains of Asia, between the Black and Caspian Seas, Syria, Palestine, the northern coast of Africa, Egypt, &c., where they sometimes increase to an incredible multitude ; and after eating up everything in their native country, favored by the wind, they perform great journeys in prodigious swarms. Their swarms often measure several hun-

dred fathoms in diameter, and are capable of darkening the sun, like thick clouds. When they have alighted in a place, they spare nothing that their

Fig. 364.



sharp teeth can master. Grain of all sorts, meadows, vineyards, and the foliage of trees, are to them equally welcome as food. They stay till they have eaten up everything in the country, and transformed it into a desert, and then they resign themselves to the guidance of the wind, wherever it may take them. Besides the locusts laying waste large tracts of country by their voracity, and causing famine, they become also a real scourge to mankind, from the stench which arises from their dead bodies when they are very numerous, and which breeds dangerous diseases.

This insect is one of the larger species of the genus to which it belongs. Its length, from the head to the points of the wings, is from two to two and a half inches. Its head and neck are green, its body brownish, the upper wings brown, melting into greenish, and with darker quadrangular spots; the under wings are transparent, and greenish towards the body. The blue upper jaws, which, on the inner surface, are furnished with sharp teeth, are very characteristic organs, which they apply effectually to devouring the vegetation.

Rye-grass Moth. — A moth injurious to the different species of grass, and other meadow herbage. The moth is of middling size; the male, with extended wings, is nearly an inch broad, and black, with yellow notches on the abdomen; the wings are thin, black, and fringed with the same color. The female has a thick, long abdomen, which is whitish-gray, and woolly at its exterior; wings small, slender, brownish-gray, and not adapted for flying. The caterpillar is found in April and May, living on rye-grass and many other plants in meadows; its ground-color is velvety-black, yellow at the incisions and sides, with a black head and small yellowish warts, having ash-gray hairs on them. The destruction of this caterpillar is very difficult, as it prefers living in long grass in the day-time, or in the ground. Break-

ing up the meadows in autumn appears to be the best method of destroying the pupæ concealed there.

Autler or Grass Moth. — A moth injurious to meadows. It is of middling size ; its head and back are yellowish-brown, the collar lighter, almost yellow ; the abdomen and legs are brownish-gray, the latter with darker joints ; the upper wings are usually brownish-gray, with a darker mixture in the middle ; the under wings are yellowish-gray. The caterpillar is brown or blackish, with five lighter stripes along the back ; the first and last sections are covered with a hard, smooth scale ; the stripes meet at the edge of the anus ; the abdomen is blackish. The larvæ are an inch long, and they undergo their transformation about midsummer, within a light cocoon, under moss, stones, &c., changing into a blackish-brown, shining pupa. The food of the caterpillar consists of all the soft sorts of grasses. It lives at the roots, and eats all the germs. Although it is in existence in autumn, lies benumbed in the earth in winter, and begins to eat again in the spring, yet the effects of its devastations appear chiefly in the beginning of June, when it has changed its skin for the last time. The only means of extirpating or diminishing this caterpillar consists in surrounding the attacked places, as the ground permits, with shallow ditches, or by means of a plough with deep furrows, as broad as possible, and turning pigs into these places to devour the insects.

VII. INSECTS INJURIOUS TO THE COTTON PLANT.

Cotton Worm. — This pest, commonly known as the "army worm," makes its appearance at intervals, sometimes even of the length of twenty years. It is produced from the eggs of a fly, deposited on the under side of the leaf of the cotton plant during the night, and hatched out in a few days. This fly belongs to the moth tribe, and has little horns projecting from the head, which terminate in a bristle-like point, are of a drab color, and measure five lines in length. Its bent wings overlap upon its body ; the under surface of the breast is of a dull, silvery-white, insensibly terminating on the abdomen and wings in a russet color, the upper surfaces of the wings and back of a changeable golden color, with iron-colored, zigzag lines traversing the surface crosswise ; the posterior margins bordered with a narrow, pale, pinkish stripe, containing small notches. A black spot marks the upper surface of each wing, about the centre of the base ; and the legs are white ; the four hinder ones being very long, as compared with those in front, which are short and slender. The insect is about nine inches long from head to tail, and measures about as much between the tips of the expanded wings. The

number of eggs which the female deposits is uncertain. When first hatched, the worm, although then but a minute living point, immediately sets to work to devour the leaf; and, when it matures, which it does very speedily, it wraps itself up in a leaf, like the caterpillar, casts its skin, becomes a chrysalis, and, in ten days, again bursts forth a perfect fly, which continues the work of reproduction. As soon as all the leaves in one field are consumed, this terrible army takes up its line of march for the neighboring one, there to prosecute the work of devastation. Late in the season, however, another fly, of the ichneumon species, seizes upon the cotton-worm as a depository for its eggs, and thus exterminates the destroying army. The cotton fly is supposed to be a native of tropical climates, and to come hither, at long intervals in search of its peculiar food, after having entirely exhausted the home supply.

This worm is furnished with six fore, eight middle, and two hind feet: the two first of the middle feet being small, imperfect, and apparently useless for the purposes of progression, which is effected by alternately stretching out the body, and again contracting it in the form of an arch. When touched the worms double themselves up, and spring to a distance several times their length; but if undisturbed when not feeding, they rest on the leaf with the fore part of the body elevated and slightly curved, sometimes varied by a sidelong, swinging motion.

Remedies.—Although many remedies have been suggested and adopted for destroying the fly before it has deposited its eggs—such as building fires or placing lights in the fields—nothing has yet proved of any avail in staying its increase after it has once made its appearance in any particular district, until it is destroyed by the ichneumon fly.

The Red Bug, or Cotton Stainer.—This is a very destructive insect on a cotton plantation, as it clusters in large numbers on the opening boll, and so discolors the cotton as to render it unfit for the fabrication of white goods. The male is about three-fifths of an inch in length from the head to the point of the abdomen; the wing-cases are flat, brownish-black, and edged with a distinct yellowish line; the under wings, hidden under the wing cases, are transparent, veined, yellowish in color, and clouded with black; the tibiae and tarsi are black; the under parts of the body, as well as the thighs of the fore legs, present a bright red appearance; and each segment of the former is marked with rings of yellowish white. The head and eyes are red; the feelers four-jointed and black. The female resembles the male in shape and color, but differs in length, measuring about seven-tenths of an inch from head to tail. The nearer the bolls approach maturity, the more injury do these bugs do to the

cotton, by depositing their fæces on the wool, and imparting to it a reddish stain, which is indelible, and considerably lessens its market value. As winter approaches, they either retire to the shelter of old stumps, or burrow into the ground at the root of the cotton plant, where they hibernate.

Remedies.—They may be collected from the plants by depositing in their vicinity small slips of sugar-cane, on which they will cluster; and they may also be greatly reduced in numbers by burning out all stumps and dead trees standing in the fields.

The Boll Worm.—This very destructive worm is hatched from the eggs of a moth, which is of a pale yellow, or shining ash color. Its body and wings are one inch and an eighth in length; the thorax is slightly convex and downy; the proboscis, which is folded spirally underneath, is double, and half an inch long; the eyes are large, clear, and yellowish-green; the feelers spindle-shaped, with very hairy joints. The abdomen and wings are white; the first being covered with downy hairs, and the latter marked with a distinct, wavy, dark band near the border. The legs are six in number. These moths multiply very rapidly; the female laying between 500 and 1000 eggs on the fourth day, and dying three or four days subsequently. During the day they lie concealed among the grass and weeds, making their excursions entirely after sunset. This insect is known as the *Phalaena Zea*, or corn moth, of which three generations are produced during the course of a year. The second brood, which is hatched late in July, or early in August, finding but little corn upon which it can prey, is forced by necessity to deposit its eggs on the buds of the cotton plant, or, as is sometimes the case, on the leaves. When first hatched, the larva spins a web, in which it wraps itself, and, if by any accident thrown from its position, it remains suspended by a single thread. After the lapse of two or three days it descends from the tops of the cotton and from the ends of the limbs, and commences its depredations by eating through the calyx of the petal contained within the flower, which causes the floral leaf to turn yellow, and the form to fall off. This operation is repeated until four or five forms are destroyed, when it enters a boll, and there lies concealed, feeding on its substance, until the time arrives for its transformation. When full-grown, the worm will measure from one to two inches in length, and, at first sight, appears to be of a pale yellow, or light green color, though it has eight longitudinal strokes of white, brown, and green, with one or two dots on each segment of the body, along the lowest streak: it is smooth and shining in appearance, being devoid of hair, with the exception of a few on each segment. It is cylin-

drical in form, and tapers a little toward each end; but it is rather thick in proportion to its length. It has sixteen legs—six in front, eight in the centre, and two behind—and creeps along with a gradual motion, quite unlike that of the army worm, which moves with a looping gait. The head is brown, smaller than the body, and oval. After changing its skin several times, and attaining its full size, the boll worm enters the ground, where it wraps itself up in a silken cocoon, and changes into a chrysalis, from which, in a month or six weeks, a perfect moth emerges.

This worm destroys an immense number of buds, which, falling off when very young, are not readily observable as they lie upon the ground, on account of their dark and withered appearance. When a bud is about to fall, the worm forsakes it, and either attacks another, or else fastens itself to a leaf, on which it remains until it sheds its skin, when it continues its ravages until it has acquired strength sufficient to enable it to penetrate the nearly-matured bolls, which, if not entirely devoured, are subsequently rotted by the moisture which penetrates through the punctures made by the worm. Bolls which have been injured by the worm, can be readily distinguished by the small hole through which it entered, and, when dissected, will frequently be found partially filled with its feces.

Remedies.—As the moth makes its excursions only after sunset, large numbers of them may be destroyed by lighting fires on the borders of the fields, to which they are attracted by the light. Success has also attended the experiment of placing plates, containing a mixture of vinegar and molasses, on stakes scattered through the fields, and the moths were thus trapped, in their eagerness to feed upon the mixture, the odor of which drew them to it in considerable numbers. The benefit derived from the introduction of a brood of young pigs into a cotton-field is incalculable, as they will scent out, root up, and devour every worm, grub, or chrysalis, without at all interfering with the cotton plants.

The Cotton Louse.—This is a species of aphid, which pierce the outer coatings of the leaves, principally on the under side, and, by constantly draining the sap from the plant, enfeeble it, and cause the leaves to curl up, turn yellow, and drop off. As the season advances, the young shoots of the plant are also attacked, and frequently covered with these pests. On their first appearance they are very minute, and of a greenish color, but as they grow older, they change to a dark green, and, in some cases, assume a nearly black color. When full grown they are about one-tenth of an inch in length, and their fecundity is most astonishing—Providence having gifted them with a procreative power possessed by no other

known insects. They are alternately oviparous and viviparous, and the sexual impregnation of one female suffices for all the generations which proceed from it during the succeeding year. The impregnated ova are deposited in the axils of the leaves, either of the cotton plant, or of some neighboring tree, and are hatched the following spring, producing wingless, six-footed larvæ, which produce brood after brood, without connexion with the male. Each succeeding brood is more fully developed than the preceding, until, at last, winged males and females are produced; by which the ova are developed, impregnated, and laid — and thus provision is made for the continuance of the species for another year. As a set-off against the enormous fecundity of this louse, they are eagerly sought for and devoured by several tribes of small birds. The ichneumon fly also destroys a large number by depositing a single egg in the body of a louse, where it is hatched into a grub, which devours the interior substance, leaving but a grey and bloated skin. Another fly, called the syrphus, also makes war upon them very vigorously; the parent fly depositing her eggs amongst the lice, where they are speedily hatched into grubs by the heat of the sun, which immediately seek for, seize, and suck out the juices of the louse, throwing away the empty skin.

VIII. ANIMALS INJURIOUS TO CULTIVATED FIELDS.

The Pocket Gopher, or Pouched Rat. — Description. — This animal, when full grown, measures eleven inches in length from the tip of the nose to the end of the tail — the latter being two inches long. The head is quite large; the nose blunt; the eyes remarkably small; the ears nearly concealed; the whiskers scant, and not as long as the head; and the incisor teeth large and protruding. On the sides of the head large pouches are situated, which are lined with fur, and extend back to the shoulders. The incisor teeth are yellow, the feet and nails white; the color of the body generally of a reddish-brown, but lighter on the belly; the legs are short; the fore feet strong, and armed with very large, curved nails, of which the centre one is the longest; the hind feet and nails are smaller, and the tail, which has generally but a scant covering of hair, is entirely bare at the tip.

Location and Habits. — The gopher is a prairie animal, confined to the Western States and Territories, and throws up a mound of earth on the prairie, in which it constructs a nest and rears its young. From the nest subterranean galleries radiate in every direction, frequently intersecting, and forming a complete labyrinth, the various turnings and windings of

which extend for miles. These galleries communicate with the surface by means of shafts constructed at intervals of a few feet apart on one side of the gallery, and through these openings the animal conveys the dirt excavated; but when they have served the purpose for which they were made, they are closed with earth from below. The main galleries measure about four inches in diameter, and the side-cuts about two or three inches. The animal conveys the earth out in its pouches, from which it is ejected by muscular force—being sometimes thrown to a distance of two feet. Loving obscurity, it rarely comes to the surface while the sun is shining, always migrating from place to place at night; and when compelled to seek food above ground, it invariably selects the night-time for that purpose. It lives on roots, and is very valiant—offering battle when interfered with. Five or six young are usually produced at a birth; though but one litter is brought forth during the year, generally in the months of March or April.

Devastations on Cultivated lands.—This animal is the pest of the prairie farmers; scarcely one crop escaping its ravages. They are very partial to meadow lands, and not only devour the roots of the grasses, but render the surface so uneven by the mounds they throw up, as to materially interfere with the operations of mowing and raking. Grain fields are also attacked; and, even after the grain is stacked, the gophers burrow under the stacks, and destroy large numbers of sheaves. All the root crops suffer by them; and in potato fields they work under the hills, and remove the tubers; sometimes destroying one-half of a crop before the withered and dying vines give warning of the mischief that is being done. Melons and pumpkins are occasionally bored out, and filled with earth, and the orchards and hedges of osage orange destroyed by cutting off their roots.

Remedies.—The only effectual mode of getting rid of this very troublesome animal is by trapping it; though it may sometimes be shot by patiently watching for it near the newly-opened shafts, which may readily be discovered by the freshly-excavated earth. Poison has been successfully used, in the form of strychnine or arsenic, introduced into vegetables, and placed in their subterranean quarters.

Silvery Mole (Scalops argenteus).—The true mole, common in England and other parts of Europe, has never yet been found in the United States, and the nearest approach to it is the shrew mole (*Scalops aquaticus*), which, in its habits, very nearly resembles the one here described, though its general habitat is the Southern and Eastern States, where it is designated the ground mole, while that of the silvery mole is the

Western and South-western States. In length, the silvery mole measures six or seven inches from the point of the nose to the root of the tail, which is about one inch long; the head, which is attached to the shoulders by a very short neck, is remarkably stout, and the flexible, cartilaginous snout projects nearly three-eighths of an inch from the upper jaw; the eyes are concealed from view; there is no external ear, and the auditory apparatus is a small hole, situated far back on the head; the fore-feet, which are large and flat, measure nearly one inch in breadth, and but little less in length, including the nails, which latter are large, flat beneath, and slightly arched above; the hind feet are slender and weak, and the soles of all the feet are entirely divested of hair, but on the upper surface they are thinly covered with short hairs, as is also the tail; the tip of the snout is entirely naked, but farther back it is sparsely clothed with short hair; the tail, snout, feet, and nails, present a light, flesh-colored appearance, and the latter are tipped with white; and the fur, which is very thick, soft, and glossy, is of a silver-grey color, slightly tinged with lead at the external ends.

Habits.—The nests of these animals are usually of considerable size, well lined with soft grass, leaves, &c., and excavated in the ground, at a depth varying from six to eighteen inches beneath the surface. They usually select an old log or stump for the location of their nest, which is approached by galleries, radiating from it in every direction, some of which are sunk below the level of the nest, and enter it from beneath. The female produces from two to four young at a birth, and appearances would seem to indicate the birth of at least two litters each year. Like all of its species, it rarely appears on the surface in daylight, except during dull and cloudy weather, confining its excursions almost entirely to the night. Its natural food is insects and worms, for which it burrows in the ground, though it is accused of destroying the root crops, and even of eating the corn after it has been planted. It is possible that the mole may resort to vegetable food to compensate for a deficiency of its usual supply of animal diet; but, whether it does or does not, the damage which it causes to the growing crops, by cutting off the roots of plants in its search for its natural prey, is of itself sufficient to constitute it a nuisance in any locality where it exists in considerable numbers; yet the enlightened agriculturist, while he takes measures for preventing an undue increase, will be careful not to exterminate an animal which destroys cut-worms, wire-worms, slugs, and all the other noxious pests usually found in the gardens and fields.

Remedies.—Dogs may be trained to follow the mole's tracks to his nest,

and dig him out; or traps of various kinds may be resorted to with considerable success. Poisoned meat, shredded fine, when freshly laid in their burrows, has proved serviceable; and in corn-fields they have been prevented from doing injury by crossing the furrows between the rows, which prevents them from readily driving their galleries through the soil,

APPENDIX.

Tables by the use of which a Farmer may be assisted in his calculations.

LAND MEASUREMENT

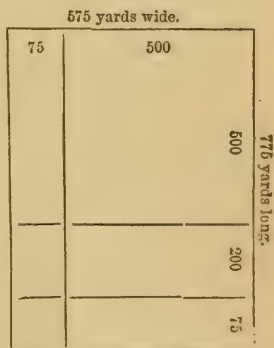
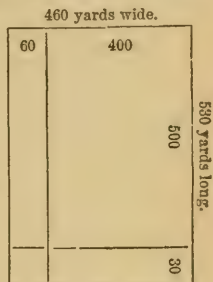
MAY be simplified by the use of the annexed Tables, by which the solid content of any piece of land may be ascertained, after its length and width in yards have been ascertained by stepping it off.

EXPLANATIONS.—If it is required to know the content of a piece of ground which measures 530 yards in length by 460 yards in breadth, take from the respective columns the sums there given: thus,

				A.	R.	P.
From under 400	and opposite	500.....		41	1	12
" " 400	" "	30.....		2	1	37
" " 60	" "	500.....		6	0	32
" " 60	" "	30.....		0	1	20
				50	1	21*

So also for the content of a piece of land 775 yards long by 575 yards wide, take—

			A.	R.	P.
From under 500 and op.	500...		51	2	24
"	"	500	200...	20	2
"	"	500	"	75...	7
"	"	75	"	500...	7
"	"	75	"	200...	3
"	"	75	"	75...	1
					0
					26
					92
					0
					12
					solid content.



If a field have unequal sides, measure it through the centre both ways, by which an average will be at once procured; or the long and short sides may be separately measured, and half the difference deducted from the longest side for the true length. The content of a triangular field may be learned by measuring the longest side, and then laying off a straight line from the centre of that side to the opposite point of the triangle: one-half the length of the straight line will give the mean width, while the length will be represented by the measure of the longest side. A field having five or more sides may also be thus measured, after it has been divided off into triangles; which may be readily done by running a line diagonally through its centre from one corner to the opposite, for the length, and then other lines from this, as a base, to the remaining corners of the field: the mean width will be one-half the length of each of these lines added together.

* In adding up the different sums, it will be necessary to observe that the perches must be divided by 40 and the roods by 4, and the roods and acres carried to their respective columns. Thus, we here have 101 as the sum of the column marked perches, which, divided by 40, the number of perches in a rood, shows that it contains 2 roods and 21 perches: we place the 21 under the column and carry 2 to the next, which will make the sum of that column, 5; but this we divide by 4, the number of roods in an acre, place the figure 1 under the rood column, and carry 1 to the acres, which then sums up 50.

↑ In making the calculations for the following tables, all parts of a perch under one-half have not been regarded, while all over one-half have been counted as a whole number. This will explain the slight discrepancy here exhibited between this answer and that obtained by a more elaborate calculation, which would show 11 perches instead of 12. (683)

TABLE I. — For reducing Yards into Acres, Rods, and Perches. — (Continued.)

Yds.	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	200	300	400	500
Yds.	A.R.P.	A.R.P.	A.R.P.	A.R.P.	A.R.P.	A.R.P.	A.R.P.	A.R.P.	A.R.P.	A.R.P.	A.R.P.	A.R.P.	A.R.P.	A.R.P.	A.R.P.	A.R.P.	A.R.P.	A.R.P.	A.R.P.	A.R.P.
1	0 0 1	0 0 1	0 0 1	0 0 1	0 0 1	0 0 2	0 0 2	0 0 2	0 0 2	0 0 2	0 0 2	0 0 3	0 0 3	0 0 3	0 0 3	0 0 3	0 0 7	0 0 10	0 0 13	0 0 17
2	0 0 2	0 0 2	0 0 2	0 0 3	0 0 3	0 0 3	0 0 4	0 0 4	0 0 4	0 0 4	0 0 5	0 0 5	0 0 6	0 0 6	0 0 6	0 0 7	0 0 13	0 0 20	0 0 26	0 0 33
3	0 0 3	0 0 3	0 0 3	0 0 4	0 0 4	0 0 5	0 0 5	0 0 6	0 0 6	0 0 7	0 0 7	0 0 8	0 0 8	0 0 9	0 0 9	0 0 10	0 0 20	0 0 30	0 0 40	0 0 50
4	0 0 4	0 0 4	0 0 4	0 0 5	0 0 5	0 0 6	0 0 6	0 0 7	0 0 7	0 0 8	0 0 9	0 0 9	0 0 10	0 0 11	0 0 12	0 0 13	0 0 26	0 0 40	0 0 53	0 0 67
5	0 0 5	0 0 5	0 0 5	0 0 6	0 0 6	0 0 7	0 0 7	0 0 8	0 0 8	0 0 9	0 0 10	0 0 10	0 0 11	0 0 12	0 0 13	0 0 14	0 0 26	0 0 40	0 0 53	0 0 67
6	0 0 6	0 0 6	0 0 6	0 0 7	0 0 7	0 0 8	0 0 8	0 0 9	0 0 9	0 0 10	0 0 11	0 0 11	0 0 12	0 0 13	0 0 14	0 0 15	0 0 26	0 0 40	0 0 53	0 0 67
7	0 0 7	0 0 7	0 0 7	0 0 8	0 0 8	0 0 9	0 0 9	0 0 10	0 0 10	0 0 11	0 0 12	0 0 12	0 0 13	0 0 14	0 0 15	0 0 16	0 0 26	0 0 40	0 0 53	0 0 67
8	0 0 8	0 0 8	0 0 8	0 0 9	0 0 9	0 0 10	0 0 10	0 0 11	0 0 11	0 0 12	0 0 13	0 0 13	0 0 14	0 0 15	0 0 16	0 0 17	0 0 26	0 0 40	0 0 53	0 0 67
9	0 0 9	0 0 9	0 0 9	0 0 10	0 0 10	0 0 11	0 0 11	0 0 12	0 0 12	0 0 13	0 0 14	0 0 14	0 0 15	0 0 16	0 0 17	0 0 18	0 0 26	0 0 40	0 0 53	0 0 67
10	0 0 10	0 0 10	0 0 10	0 0 11	0 0 11	0 0 12	0 0 12	0 0 13	0 0 13	0 0 14	0 0 15	0 0 15	0 0 16	0 0 17	0 0 18	0 0 19	0 0 26	0 0 40	0 0 53	0 0 67
11	0 0 11	0 0 11	0 0 11	0 0 12	0 0 12	0 0 13	0 0 13	0 0 14	0 0 14	0 0 15	0 0 16	0 0 16	0 0 17	0 0 18	0 0 19	0 0 20	0 0 26	0 0 40	0 0 53	0 0 67
12	0 0 12	0 0 12	0 0 12	0 0 13	0 0 13	0 0 14	0 0 14	0 0 15	0 0 15	0 0 16	0 0 17	0 0 17	0 0 18	0 0 19	0 0 20	0 0 21	0 0 26	0 0 40	0 0 53	0 0 67
13	0 0 13	0 0 13	0 0 13	0 0 14	0 0 14	0 0 15	0 0 15	0 0 16	0 0 16	0 0 17	0 0 18	0 0 18	0 0 19	0 0 20	0 0 21	0 0 22	0 0 26	0 0 40	0 0 53	0 0 67
14	0 0 14	0 0 14	0 0 14	0 0 15	0 0 15	0 0 16	0 0 16	0 0 17	0 0 17	0 0 18	0 0 19	0 0 19	0 0 20	0 0 21	0 0 22	0 0 23	0 0 26	0 0 40	0 0 53	0 0 67
15	0 0 15	0 0 15	0 0 15	0 0 16	0 0 16	0 0 17	0 0 17	0 0 18	0 0 18	0 0 19	0 0 20	0 0 20	0 0 21	0 0 22	0 0 23	0 0 24	0 0 26	0 0 40	0 0 53	0 0 67
16	0 0 16	0 0 16	0 0 16	0 0 17	0 0 17	0 0 18	0 0 18	0 0 19	0 0 19	0 0 20	0 0 21	0 0 21	0 0 22	0 0 23	0 0 24	0 0 25	0 0 26	0 0 40	0 0 53	0 0 67
17	0 0 17	0 0 17	0 0 17	0 0 18	0 0 18	0 0 19	0 0 19	0 0 20	0 0 20	0 0 21	0 0 22	0 0 22	0 0 23	0 0 24	0 0 25	0 0 26	0 0 26	0 0 40	0 0 53	0 0 67
18	0 0 18	0 0 18	0 0 18	0 0 19	0 0 19	0 0 20	0 0 20	0 0 21	0 0 21	0 0 22	0 0 23	0 0 23	0 0 24	0 0 25	0 0 26	0 0 27	0 0 26	0 0 40	0 0 53	0 0 67
19	0 0 19	0 0 19	0 0 19	0 0 20	0 0 20	0 0 21	0 0 21	0 0 22	0 0 22	0 0 23	0 0 24	0 0 24	0 0 25	0 0 26	0 0 27	0 0 28	0 0 26	0 0 40	0 0 53	0 0 67
20	0 0 20	0 0 20	0 0 20	0 0 21	0 0 21	0 0 22	0 0 22	0 0 23	0 0 23	0 0 24	0 0 25	0 0 25	0 0 26	0 0 27	0 0 28	0 0 29	0 0 26	0 0 40	0 0 53	0 0 67
25	0 0 25	0 0 25	0 0 25	0 0 26	0 0 26	0 0 27	0 0 27	0 0 28	0 0 28	0 0 29	0 0 30	0 0 30	0 0 31	0 0 32	0 0 33	0 0 34	0 0 33	0 0 40	0 0 53	0 0 67
30	0 0 30	0 0 30	0 0 30	0 0 31	0 0 31	0 0 32	0 0 32	0 0 33	0 0 33	0 0 34	0 0 35	0 0 35	0 0 36	0 0 37	0 0 38	0 0 39	0 0 33	0 0 40	0 0 53	0 0 67
35	0 0 35	0 0 35	0 0 35	0 0 36	0 0 36	0 0 37	0 0 37	0 0 38	0 0 38	0 0 39	0 0 40	0 0 40	0 0 41	0 0 42	0 0 43	0 0 44	0 0 33	0 0 40	0 0 53	0 0 67
40	0 0 40	0 0 40	0 0 40	0 0 41	0 0 41	0 0 42	0 0 42	0 0 43	0 0 43	0 0 44	0 0 45	0 0 45	0 0 46	0 0 47	0 0 48	0 0 49	0 0 33	0 0 40	0 0 53	0 0 67
45	0 0 45	0 0 45	0 0 45	0 0 46	0 0 46	0 0 47	0 0 47	0 0 48	0 0 48	0 0 49	0 0 50	0 0 50	0 0 51	0 0 52	0 0 53	0 0 54	0 0 33	0 0 40	0 0 53	0 0 67
50	0 0 50	0 0 50	0 0 50	0 0 51	0 0 51	0 0 52	0 0 52	0 0 53	0 0 53	0 0 54	0 0 55	0 0 55	0 0 56	0 0 57	0 0 58	0 0 59	0 0 33	0 0 40	0 0 53	0 0 67
55	0 0 55	0 0 55	0 0 55	0 0 56	0 0 56	0 0 57	0 0 57	0 0 58	0 0 58	0 0 59	0 0 60	0 0 60	0 0 61	0 0 62	0 0 63	0 0 64	0 0 33	0 0 40	0 0 53	0 0 67
60	0 0 60	0 0 60	0 0 60	0 0 61	0 0 61	0 0 62	0 0 62	0 0 63	0 0 63	0 0 64	0 0 65	0 0 65	0 0 66	0 0 67	0 0 68	0 0 69	0 0 33	0 0 40	0 0 53	0 0 67
65	0 0 65	0 0 65	0 0 65	0 0 66	0 0 66	0 0 67	0 0 67	0 0 68	0 0 68	0 0 69	0 0 70	0 0 70	0 0 71	0 0 72	0 0 73	0 0 74	0 0 33	0 0 40	0 0 53	0 0 67
70	0 0 70	0 0 70	0 0 70	0 0 71	0 0 71	0 0 72	0 0 72	0 0 73	0 0 73	0 0 74	0 0 75	0 0 75	0 0 76	0 0 77	0 0 78	0 0 79	0 0 33	0 0 40	0 0 53	0 0 67
75	0 0 75	0 0 75	0 0 75	0 0 76	0 0 76	0 0 77	0 0 77	0 0 78	0 0 78	0 0 79	0 0 80	0 0 80	0 0 81	0 0 82	0 0 83	0 0 84	0 0 33	0 0 40	0 0 53	0 0 67
80	0 0 80	0 0 80	0 0 80	0 0 81	0 0 81	0 0 82	0 0 82	0 0 83	0 0 83	0 0 84	0 0 85	0 0 85	0 0 86	0 0 87	0 0 88	0 0 89	0 0 33	0 0 40	0 0 53	0 0 67
85	0 0 85	0 0 85	0 0 85	0 0 86	0 0 86	0 0 87	0 0 87	0 0 88	0 0 88	0 0 89	0 0 90	0 0 90	0 0 91	0 0 92	0 0 93	0 0 94	0 0 33	0 0 40	0 0 53	0 0 67
90	0 0 90	0 0 90	0 0 90	0 0 91	0 0 91	0 0 92	0 0 92	0 0 93	0 0 93	0 0 94	0 0 95	0 0 95	0 0 96	0 0 97	0 0 98	0 0 99	0 0 33	0 0 40	0 0 53	0 0 67
95	0 0 95	0 0 95	0 0 95	0 0 96	0 0 96	0 0 97	0 0 97	0 0 98	0 0 98	0 0 99	0 0 100	0 0 100	0 0 101	0 0 102	0 0 103	0 0 104	0 0 33	0 0 40	0 0 53	0 0 67
100	0 0 100	0 0 100	0 0 100	0 0 101	0 0 101	0 0 102	0 0 102	0 0 103	0 0 103	0 0 104	0 0 105	0 0 105	0 0 106	0 0 107	0 0 108	0 0 109	0 0 33	0 0 40	0 0 53	0 0 67
200	1 0 5	1 0 5	1 0 5	1 0 6	1 0 6	1 0 7	1 0 7	1 0 8	1 0 8	1 0 9	1 0 10	1 0 10	1 0 11	1 0 12	1 0 13	1 0 14	1 0 33	1 0 40	1 0 53	1 0 67
300	1 1 2	1 1 2	1 1 2	1 1 3	1 1 3	1 1 4	1 1 4	1 1 5	1 1 5	1 1 6	1 1 7	1 1 7	1 1 8	1 1 9	1 1 10	1 1 11	1 1 33	1 1 40	1 1 53	1 1 67
400	2 0 11	2 0 11	2 0 11	2 0 12	2 0 12	2 0 13	2 0 13	2 0 14	2 0 14	2 0 15	2 0 16	2 0 16	2 0 17	2 0 18	2 0 19	2 0 20	2 0 33	2 0 40	2 0 53	2 0 67
500	2 2 13	2 2 13	2 2 13	2 2 14	2 2 14	2 2 15	2 2 15	2 2 16	2 2 16	2 2 17	2 2 18	2 2 18	2 2 19	2 2 20	2 2 21	2 2 22	2 2 33	2 2 40	2 2 53	2 2 67

TABLE II.

Exhibiting the Number of Plants which may be raised on a Perch of Land, at different Distances :

Trees or Plants.	Number of Inches asunder.	Square Inches to each.	Inches over.
261	15 by 10	150	54
272	12 — 12	144	36
392	10 — 10	100	4
490	10 — 8	80	4
612	8 — 8	64	36
816	8 — 6	48	36
1069	6 — 6	36	...
1633	6 — 4	24	12
1960	5 — 4	20	...
2450	4 — 4	16	4

TABLE III.

Exhibiting the Number of Plants which may be raised on an Acre of Land, at different Distances :

Trees or Plants.	Number of Feet asunder.	Square Feet to each.	Inches over.
108	20 by 20	400	360
134	18 — 18	324	144
160	$16\frac{1}{2}$ — $16\frac{1}{2}$	$272\frac{1}{4}$	...
302	12 — 12	144	72
435	10 — 10	100	60
680	8 — 8	64	40
888	7 — 7	49	48
1089	8 — 5	40	...
1210	6 — 6	36	...
1361	8 — 4	32	8
1452	6 — 5	30	...
1555	7 — 4	28	20
1815	6 — 4	24	...
2178	5 — 4	20	...
2722	4 — 4	$16\frac{1}{2}$	8
2904	5 — 3	15	...
3630	4 — 3	12	...
4840	3 — 3	9	...
5445	4 — 2	8	...
7260	3 — 2	6	...
8712	$2\frac{1}{2}$ — 2	5	...
10,890	2 — 2	4	...
19,305	$1\frac{1}{2}$ — $1\frac{1}{2}$	$2\frac{1}{2}$	...
21,780	2 — 1	2	...
43,560	1 — 1	1	...

TABLE IV.—Rotations practised in Pennsylvania.—(Farmer's Cabinet).

Years.	Field No.1	Field No.2	Field No.3	Field No.4	Field No.5	Field No.6	Field No.7	Field No.8
1st Year.....	Wheat	Rye	Wheat	Clover	Corn	Wheat	Clover	Oats
2d "	Rye	Clover	Corn	Wheat	Oats	Clover	Wheat	Wheat
3d "	Clover	Wheat	Oats	Rye	Wheat	Wheat	Corn	Clover
4th "	Wheat	Corn	Wheat	Clover	Clover	Rye	Oats	Wheat
5th "	Corn	Oats	Clover	Wheat	Wheat	Clover	Wheat	Rye
6th "	Oats	Wheat	Wheat	Corn	Rye	Wheat	Clover	Clover
7th "	Wheat	Clover	Rye	Oats	Clover	Corn	Wheat	Wheat
8th "	Clover	Wheat	Clover	Wheat	Wheat	Oats	Rye	Corn

TABLE V.—For determining the Weight of Cattle by Measurement.

Girth.	Length.	Weight.	Girth.	Length.	Weight.
<i>ft. in.</i>	<i>ft. in.</i>	<i>lbs.</i>	<i>ft. in.</i>	<i>ft. in.</i>	<i>lbs.</i>
4 3	3 0	180	6 6	4 6	633
	3 3	195		4 9	668
	3 6	210		5 0	704
	3 9	225		5 3	739
	4 0	240		5 6	774
4 6	3 0	202		5 9	809
	3 3	219		6 0	844
	3 6	236		6 3	882
	3 9	253	6 9	4 6	683
	4 0	270		4 9	721
	4 3	286		5 0	759
4 9	3 3	244		5 3	797
	3 6	263		5 6	835
	3 9	282		5 9	874
	4 0	300		6 0	911
	4 3	319		6 3	949
	4 6	338	7 0	4 9	776
	4 9	357		5 0	816
5 0	3 3	271		5 3	857
	3 6	292		5 6	898
	3 9	315		5 9	939
	4 0	334		6 0	979
	4 3	355		6 3	1020
	4 6	377		6 6	1061
	4 9	398	7 3	4 9	832
	5 0	420		5 0	876
5 3	3 3	298		5 3	919
	3 6	321		5 6	963
	3 9	344		5 9	1007
	4 0	367		6 0	1051
	4 3	390		6 3	1095
	4 6	413		6 6	1138
	4 9	436	7 6	5 0	937
	5 0	459		5 3	984
5 6	3 6	362		5 6	1031
	3 9	378		5 9	1078
	4 0	403		6 0	1125
	4 3	428		6 3	1171
	4 6	453		6 6	1218
	4 9	478		6 9	1265
	5 0	504	7 9	5 0	1001
	5 3	529		5 3	1051
5 9	3 9	413		5 6	1101
	4 0	440		5 9	1151
	4 3	468		6 0	1201
	4 6	495		6 3	1251
	4 9	523		6 6	1301
	5 0	551		6 9	1351
	5 3	579		7 0	1400
	5 6	606	8 0	5 3	1120
6 0	4 3	510		5 6	1173
	4 6	540		5 9	1226
	4 9	570		6 0	1280
	5 0	600		6 3	1333
	5 3	630		6 6	1386
	5 6	660		6 9	1440
	5 9	690		7 0	1493
	6 0	722	8 3	5 6	1247
6 3	4 6	585		5 9	1304
	4 9	618		6 0	1361
	5 0	651		6 3	1417
	5 3	683		6 6	1474
	5 6	716		6 9	1531
	5 9	748		7 0	1588
	6 0	781		7 3	1644
	6 3	814			

This Method of ascertaining the Weight of Cattle while living is of the utmost utility to all those who are not experienced judges by the eye, and, by the following directions, the weight can be ascertained within a mere trifle. The beast standing square, take a string and put it round the body just behind the shoulder-blade; measure with a foot-rule the circumference of the animal in feet and inches, which is called the girth; then with the string measure from the bone of the tail, which plumbs the line with the hinder part of the buttock, along the back to the fore-part of the shoulder-blade; take the dimensions with the foot-rule, as before, which is the length, and work the figures in the following manner: Girth of the bullock, 6 feet 4 inches; length, 5 feet 3 inches; which, multiplied together, make $33\frac{1}{4}$ square superficial feet; that, again, multiplied by 23 (the number of pounds allowed to each superficial foot of all cattle measuring less than 7 and more than 5 feet in girth), makes 765 lbs. Where the animal measures less than 9 and more than 7 feet in girth, 31 is the number of pounds to each superficial foot. Supposing any small beast should measure 2 feet in girth, and 2 feet along the back, which, multiplied together, make 4 square feet; and that, multiplied by 11 (the number of pounds allowed for each square foot of cattle measuring less than 3 in girth), makes 44 lbs. Again, suppose a calf, sheep, etc. should measure 4 feet 6 inches in girth, and 3 feet 9 inches in length; these, multiplied together, make $163\frac{1}{4}$ square feet; which, multiplied by 16 (the number of pounds allowed to all cattle measuring less than 5 feet and more than 3 in girth), gives 268 lbs. The girth and length of black cattle, sheep, calves, or hogs, may be as exactly taken in this way as will be necessary for any computation or valuation of stock, and will answer exactly to the weight of the four quarters, exclusive of the offal. A deduction must be made for a half-fatted beast of 1 pound in 20 from that of a fat one; and for a cow that has had calves, 1 pound additional in every 20 must be allowed.

TABLE VI.—*Mixtures of Grass Seed * recommended for Pastures, Lawns, Mowing-Grounds, etc. on different kinds of Soils, and the Quantity to be sown on each Acre, together with the weight per bushel of each kind of Seed, etc. etc.*
(Compiled from Flint's "Grasses and Forage Plants.")

NAMES OF GRASSES.	For Permanent Pas- ture.		For Permanent Pas- ture.		For Permanent Lawn Grasses.		For Pastures.		For Fine Lawns, mown frequently.		For Mowing and Pas- ture in orchards and shaded places.		For Mowing in the ro- tation—1 year's hay.		For Mowing in the ro- tation—1 year's pasture.		For Mowing in the ro- tation—1 year's pasture, and 2 years' pasture.		For Mowing on light Lands.		For reclaimed peaty Lands.		For Peaty soils, liable to occasional overflow by fresh water.		For Alluvial soils, liable to occasional over- flow by fresh water.		For Rocky Hills.		For Dry Gravels.		Weight per bushel of each kind of seed.		Average number of seeds to an ounce.		Depth of soil at which the greatest number of seeds germinate, in an inch.		Average per cent. of loss when cut in flow- ering time, and made into hay.			
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	inches.	per cent.			
Crested Dog's Tail.....	
Floria.....	
Fowl Meadow Grass.....
Hard Fescue.....
Italian Rye Grass.....
June Grass.....
Manna Grass.....
Meadow Fescue.....
Meadow Foxtail.....
Meadow Soft Grass.....
Orchard Grass.....
Perennial Rye Grass.....
Perennial Red Clover.....
Reed Canary Grass.....
Red Fescue.....
Red Clover.....
Relltop.....
Rough-Stalked Meadow Sheep's Fescue.....
Soft Brume Grass.....
Sweet-Scented Vernal.....
Slender-Spiked Fescue.....
Tail Fescue.....																		

* These mixtures were originally prepared for, and used on Scottish soil; but our climate not varying much from that of Scotland, except during the middle of summer, when we have a greater amount of hot, dry weather, the majority of them will suit for use here, as they now stand, and the remainder with but slight modifications to suit the locality.

TABLE VII.

Exhibiting the Distance ordinarily travelled by a Horse in ploughing an Acre of Land, together with the Quantity of Land worked during a Day 9 hours long—supposing the Horse to travel at the rate of 16 and 18 miles per day, respectively.

Width of Furrow-Slice in Inches.	No. of miles travelled over in ploughing 1 acre of land.	Number of acres ploughed per day of 9 hours, the horse travelling at the rate of 18 miles per day.	Number of acres ploughed per day of 9 hours, the horse travelling at the rate of 16 miles per day.	Width of Furrow-Slice in Inches.	No. of miles travelled over in ploughing 1 acre of land.	Number of acres ploughed per day of 9 hours, the horse travelling at the rate of 18 miles per day.	Number of acres ploughed per day of 9 hours, the horse travelling at the rate of 16 miles per day.
7	14 1-8	1 1-4	1 1-8	46	12 1-6	8 1-3	7 2-5
8	12 1-4	1 1-2	1 1-4	47	12 1-10	8	7 3-5
9	11	1 3-5	1 1-2	48	12 1-12	8 3-4	7 3-4
10	9 9-10	1 4-5	1 3-5	49	2	8 9-10	7 9-10
11	9	2	1 3-4	50	2	9 9-10	8 1-10
12	8 1-4	2 1-5	1 9-10	51	1 9-10	9 1-5	8 1-4
13	7 1-2	2 1-3	2 1-10	52	1 9-10	9 1-2	8 2-5
14	7	2 1-2	2 1-4	53	1 9-10	9 3-4	8 1-2
15	6 1-2	2 3-4	2 2-5	54	1 4-5	9 4-5	8 9-10
16	6 1-6	2 9-10	2 3-5	55	1 4-5	10	8
17	5 3-4	3 1-10	2 3-4	56	1 3-4	10 1-4	9
18	5 1-2	3 1-4	2 9-10	57	1 3-4	10 2-5	9 1-5
19	5 1-4	3 1-2	3 1-10	58	1 7-10	10 3-5	9 1-2
20	4 9-10	3 3-5	3 1-4	59	1 7-10	10 3-4	9 1-2
21	4 7-10	3 4-5	3 1-3	60	1 3-5	10 9-10	9 7-10
22	4 1-2	4	3 1-2	61	1 3-5	11 1-5	9 4-5
23	4 1-4	4 1-5	3 7-10	62	1 3-5	11 1-3	10
24	4	4 1-3	3 9-10	63	1 3-5	11 1-2	10 1-5
25	4	4 1-2	4	64	1 1-2	11 7-10	10 1-3
26	3 4-5	4 3-4	4 1-5	65	1 1-2	11 4-5	10 1-2
27	3 3-5	4 9-10	4 1-2	66	1 1-2	12	10 3-5
28	3 1-2	5 3-8	4 1-2	67	1 1-2	12 1-4	10 4-5
29	3 1-2	5 1-4	4 3-5	68	1 1-2	12 2-5	11
30	3 1-2	5 3-4	4 4-5	69	1 2-5	12 3-5	11 1-8
31	3 1-5	5	5	70	1 2-5	12 3-4	11 1-3
32	3 1-10	5 4-5	5 1-4	71	1 2-5	12 9-10	11 1-2
33	3	6	5 1-3	72	1 2-5	13 1-8	11 3-5
34	2 9-10	6 1-5	5 1-2	73	1 1-3	13 1-3	11 4-5
35	2 4-5	6 1-3	5 3-5	74	1 1-2	13 1-2	12
36	2 3-4	6 1-2	5 4-5	75	1 1-3	13 2-5	12 1-8
37	2 2-3	6 1-4	6	76	1 3-10	13 4-5	12 1-4
38	2 3-5	6 9-10	6 1-8	77	1 3-10	14	12 1-2
39	2 1-2	7 1-8	6 1-3	78	1 1-4	14 1-4	12 3-5
40	2 1-2	7 1-2	6 1-2	79	1 1-4	14 2-5	12 3-4
41	2 2-5	7 3-4	6 3-4	80	1 1-4	14 3-5	12 9-10
42	2 1-3	7	6 2-3	81	1 1-5	14 3-4	13 1-10
43	2 3-10	7 4-5	7	82	1 1-5	15	13 1-4
44	2	8	7 1-10	83	1 1-5	15 1-8	13 2-5
45	2 1-5	8 1-6	7 1-4	84	1 1-6	15 1-3	13 3-5

TABLE VIII.

Live and Dead Weight of Cattle.

The dead weight generally approaches three-fifths of the live weight, or about 55 per cent.; though it sometimes differs widely, as the following table of actual observations will demonstrate:

DESCRIPTION OF ANIMAL.	Live Weight in pounds.	Dead Weight in pounds.	Tallow—Pounds.
An Aberdeenshire ox.....	1850	1182	229
A short-horned heifer.....	1684	1087	218
A short-horned ox.....	1848	1261	196
A short-horned steer.....	1685	945	208

TABLE IX.

Showing how much Manure will be necessary to an Acre of Ground, supposing the Heaps to be of certain Sizes, and deposited at definite Distances :

SUPPOSED NUMBER OF HEAPS IN EACH LOAD.	NUMBER OF LOADS REQUIRED TO THE ACRE, IF THE HEAPS ARE PLACED										
	6 Feet apart.	9 Feet apart.	12 Feet apart.	15 Feet apart.	18 Feet apart.	21 Feet apart.	24 Feet apart.	27 Feet apart.	30 Feet apart.	33 Feet apart.	36 Feet apart.
1	1210	538	303	294	135	99	76	60	49	40	34
2	605	269	152	97	68	50	38	30	25	20	17
3	404	180	101	65	45	33	26	20	17	13	11
4	303	135	76	49	34	25	19	15	13	10	8
5	242	108	61	39	27	20	16	12	10	8	7
6	202	90	51	33	23	17	13	10	9	7	6
7	173	77	44	28	20	15	11	9	7	5	5
8	152	68	38	25	17	13	10	8	7	5	4
9	135	60	34	22	15	11	9	7	6	5	4
10	121	54	31	20	14	10	8	6	5	4	3

TABLE X.

The Results of Observations on the Reproductive Powers of Domestic Birds and Animals.

KINDS OF ANIMALS.	Proper Age for Repro- duction.	Period of du- ration of the Power of Repro- duction.	Proportional Number of Females to each Male.	Season for Copulation	GESTATION AND INCU- BATION.		
					Short- est Pe- riod.	Mean Period.	Longest Period.
Mare	4 years.	Years. 10 to 12	.....	May	Days. 322	Days. 347	Days. 419
Stallion	5 "	12 to 15	20 to 30	.....	.....	.....	.....
Cow	3 "	10	.....	June	240	283	321
Bull	3 "	5	30 to 40	.....	.....	.....	.....
Ewe	2 "	6	.....	Nov.	146	154	161
Sow	1 "	6	.....	March	109	115	143
Boar	1 "	6	6 to 10	.....	.....	.....	.....
She-Goat	2 "	6	.....	Nov.	150	156	163
He-Goat	2 "	5	20 to 40	.....	.....	.....	.....
She-Ass	4 "	10 to 12	.....	May	365	380	391
He-Ass	5 "	12 to 15	.....	.....	.....	.....	.....
Bitch	2 "	8 to 9	.....	Feb.	55	60	63
Dog	2 "	8 to 9	.....	.....	.....	.....	.....
Cock	6 months	5 to 6	12 to 15	.....	.....	.....	.....
Turkey, sit- ting on the } Hen .....	.....	.....	.....	.....	17	24	28
eggs of the } Turkey .....	.....	.....	.....	.....	24	27	30
Hen, sitting on the eggs } Duck .....	.....	.....	.....	.....	24	26	30
of the } Hen .....	.....	3 to 5	.....	.....	26	30	34
Duck .....	.....	.....	.....	.....	19	21	24
Goose .....	.....	.....	.....	.....	28	30	32
Pigeon .....	.....	.....	.....	.....	27	30	33
					16	18	20

TABLE XI.

The proportion of Inorganic Substances contained in several of the most commonly cultivated Esculents.

(Prof. Johnston's Lectures.)

INORGANIC SUBSTANCES.	PERCENTAGE OF CONTAINED IN						
	Wheat.	Oats without husk.	Barley.	Rye.	Field Beans.	Peas.	Turnips. Potatoes.
Potash.....	27.72	26.18	13.64	22.08	33.56	36.05	39.82 55.75
Soda.....	9.05	.....	8.14	11.67	10.60	7.42	10.86 1.86
Lime.....	2.81	5.95	2.62	4.93	5.77	5.29	12.75 2.07
Magnesia.....	12.03	9.95	7.46	10.35	7.99	8.46	4.08 5.28
Oxide of iron.....	0.67	0.40	1.48	1.36	0.56	0.99	0.89 0.52
Oxide of manganese.....	.....	.....	.....	.....	.....	.....	.....
Phosphoric acid.....	49.81	43.84	38.93	49.55	37.57	33.29	6.69 12.57
Sulphuric Acid.....	0.24	10.45	0.10	0.98	1.00	4.36	13.15 13.65
Chlorine.....	.....	0.26	0.04	.....	0.73	.....	3.68 4.27
Chloride of sodium.....	.....	.....	.....	.....	.....	3.13	.....
Alumina.....	.....	0.06	0.21	.....	.....	.....	.....
Silica.....	1.17	2.67	27.10	0.43	1.15	0.51	7.05 4.23
	99.50	99.76	99.72	101.35	98.93	100.00	99.57 100.20

TABLE XII.

The proportion of Inorganic Substances contained in the Refuse of the most commonly cultivated Esculents.

(Prof. Johnston's Lectures.)

INORGANIC SUBSTANCES.	PERCENTAGE OF CONTAINED IN						
	Straw of Wheat.	Straw of Oats.	Husk of Oats.	Straw of Barley.	Straw of Rye.	Straw of Beans.	Straw of Peas.
Potash.....	12.44	19.14	8.13	6.31	17.36	53.08	4.73
Soda.....	0.16	9.69	.....	0.61	0.31	1.60	.....
Lime.....	6.70	8.07	3.15	9.53	9.06	19.99	54.91
Magnesia.....	3.82	3.78	1.09	3.22	2.41	6.69	6.88
Oxide of iron.....	1.30	1.83	1.33	0.83	1.36	0.22	0.40
Oxide of manganese.....	.....	.....	0.61	.....	.....	0.16	0.15
Phosphoric acid.....	3.07	2.50	1.54	3.08	3.82	7.24	4.83
Sulphuric acid.....	5.82	3.25	6.46	1.63	0.83	1.09	6.77
Chlorine.....	1.09	3.25	0.73	0.97	0.46	2.56	0.09
Chloride of sodium.....	.....	.....	.....	.....	.....	.....	.....
Alumina.....	.....	.....	.....	1.39	.....	0.32	1.21
Silica.....	65.38	48.42	76.16	70.58	64.50	7.05	20.03
	99.78	100.00	99.20	98.15	100.11	100.00	100.00

TABLE XIII.

The proportion of several Elementary Substances contained in 100 parts of some of the most commonly cultivated Esculents.

(Prof. Johnston's Lectures.)

SUBSTANCES.	PERCENTAGE OF					
	Water.	Husks or woody fibre.	Starch, Gum, and Sugar.	Gluten, Albumen, Caseine, etc.	Fatty Matter.	Saline Matter.
Wheat	15	15	55	10 to 19	2 to 4	2
Barley	15	15	60	12 to 15	2 to 3	3
Oats	16	20	60	14 to 19	5 to 7	4
Rye	12	10 to 20	60	10 to 15	3 to 4	2
Indian corn.....	14	6	70	12	5 to 9	1½
Buckwheat	15	25	50	8	0.4	4
Rice.....	13	3	75	7	0.7	0½
Beans.....	14	8.11	40	24.23	2.3	3
Peas	14	9	50	24	2.1	3
Potatoes.....	75	4	18	2	0.3	1
Turnips.....	88	2	9	1.5	0.3	1½ to 4.5
Carrots	85	3	10	1.5	0.4	1½ to 2
Mangel-Wurzel.....	85	2	11	2.0	.....	¾ to 1¼
Meadow hay	14	30	40	7.1	2 to 5	5 to 10
Clover hay.....	14	25	40	9.3	3 to 5	9
Pea straw.....	10 to 15	25	45	12.3	1.5	4 to 6
Oat straw.....	12	45	35	1.3	0.8?	6
Wheat straw.....	12 to 15	50	30	1.3	2 to 3½	5
Barley straw.....	12 to 15	50	30	1.3	.....	5
Rye straw.....	12 to 15	45	33	1.3	.....	4
Indian corn stalks....	12	25	52	3.0	1.7	3 to 7

TABLE XIV.

The proportion of several Elementary Substances contained in the produce of one Acre planted with the Esculents most commonly cultivated as food for Stock.

(Prof. Johnston's Lectures.)

The starch, gum, and sugar form fat, while the gluten, albumen, and caseine add to the flesh and muscle.

ONE ACRE PLANTED IN	Produced per Acre.	Weight of Grain per Bushel.	Weight of Gluten, Albumen, and Caseine in the produce of one Acre.	Weight of Starch, Gum, Sugar, and Fat, in the produce of one Acre.	Weight of Water in the produce of one Acre.
		lbs.	lbs.	lbs.	lbs.
Field beans.....	25 bush.	64	450	672	256
Peas.....	25 "	66	380	845	208
Oats	50 "	42	290	1,168	336
Hay	3 tons.	...	480	2,790	752
Potatoes.....	12 "	...	600	3,330	20,250
Carrots.....	25 "	...	1,200	5,800	47,000
Turnips.....	30 "	...	800	6,700	56,950
Wheat straw.....	3,000 lbs.	...	40	940	450
Oat straw.....	2,700 "	...	36	970	324
Barley straw.....	2,100 "	...	28	646	252

DEFINITION OF WORDS,

SCIENTIFIC, TECHNICAL, AND PECULIAR,

COMMONLY USED IN CONNECTION WITH AGRICULTURAL AND KINDRED SUBJECTS.



Abdomen.—Lower part or lower belly of an animal.

Abrasion.—Wearing or rubbing.

Acari.—Ticks; small articulated insects.

Acetate.—A neutral salt.

Achromatic.—Destitute of color.

Acrid.—Sharp, pungent, bitter.

Aculeated.—Having prickly points.

Acute-lobed.—Having pointed divisions.

Aerate.—To combine with carbonic acid or fixed air.

Aftermath.—A second crop of grass in the same season.

Albumen.—A substance found in some seeds and vegetables, resembling in character the white of an egg.

Albumum.—The softer part of wood, between the inner bark and the wood; sap.

Alkaline.—Having the properties of alkali.

Alluvion.—Alluvial land.

Alterative.—A medicine which changes the habit, and restores healthy functions.

Aluminous.—Pertaining to alum or alumina.

Ammonia.—A volatile alkali, existing in its purest form in a state of gas.

Amphibious.—Capable of living in air and water.

Animalcula.—An animal, the figure of which is discernible only through a magnifying glass.

Annual.—A plant that lives only during one year.

Annular.—Having the form of a ring.

Antennae.—The horns or feelers of insects, projecting from the head.

Anterior.—Before, in time or place; prior.

Anther.—The case or part of the flower containing pollen, or the male part of a flower.

Antiseptic.—Opposing or counteracting putrefaction.

Aperient.—Opening; laxative.

Apez.—The tip, point, or summit, of anything.

Aphis.—A genus of insects; vine-fretter; plant-louse.

Apterous.—A wingless insect.

Arable.—Fit for ploughing or tillage.

Aroma.—The odoriferous principle; a pleasant smell.

Aromatic.—Fragrant; spicy; odoriferous.

Arsenious.—Containing arsenic.

Artery.—A vessel or tube conveying blood from the heart to all parts of the body.

Ascescent.—Having a tendency to sourness; acidity.

Astringent.—Binding; strengthening; opposed to laxative.

Atlas.—The first joint of the neck.

Aviary.—An enclosure for keeping birds confined.

Awon.—The beard or bristles of grain and grasses.

Awined.—Having a beard.

Awless.—Destitute of a beard.

Axil.—The space or angle formed by a branch or a leaf with the stem.

Azotized.—From azote, a gas fatal to animal life.

Basal.—Pertaining to or constituting the base.

Base.—The principle matter of a mixture or composition.

Bast.—Rope, or cord, made of the bark of the lime-tree or linden.

Batten.—To fatten. A piece of board or scantling, a few inches wide.

Bay.—An enclosed place, in a barn, for depositing hay.

Bere.—The name of a species of Scotch barley.

Biennial.—Once in two years; continuing two years.

Bifurcation.—A forking, or division into two branches.

Big.—A species of barley.

Blanched.—Whitened.

Bout.—A turn; a single part of an action carried on at successive intervals.

Brindle.—Spottedness.

Butyraceous.—Resembling butter.

Calcareous.—Partaking of the nature of lime.

Calced.—Reduced to a powder by the action of heat.

Calyxine.—Relating to, or like, a calyx.

Calyx.—The outer covering of a flower.

- Cambium.**—A glutinous secretion, which, in spring, separates the albumen of a plant from its inner bark.
- Capsule.**—The seed-vessel of a plant.
- Carbon.**—Pure charcoal.
- Carbonaceous.**—Pertaining to charcoal.
- Cartilage.**—Gristle.
- Casous.**—Resembling cheese.
- Caudescent.**—Having a perfect stem; rooted like the cabbage.
- Caustic.**—Any substance which, applied to living animals, acts like fire.
- Cellular.**—Consisting of or containing cells.
- Cellulose.**—The substance left after the action of solvents upon vegetable tissues.
- Chap.**—The upper and lower part of the jaw.
- Chermes.**—An insect.
- Chine.**—The backbone or spine of an animal.
- Chronic.**—Continuing a long time.
- Chrysalis.**—The second apparent change of the maggot of an insect, before its appearance as a butterfly.
- Churr-worm.**—An insect that turns about nimbly.
- Chyle.**—A whitish fluid separated from food by means of digestion.
- Cleat.**—A piece of wood used to fasten ropes upon.
- Coagulate.**—To curdle; to thicken; to change from a fluid to a solid mass.
- Cocoon.**—An oblong ball, or covering of silk, fabricated by the silk-worm; the egg-shaped case of the chrysalis.
- Collateral.**—Being by the side; side by side; on the side; side to side.
- Cutter.**—The fore iron of a plough, with a sharp edge, that cuts the earth or sod.
- Concave.**—Hollow; arched, like the inner surface of a spherical body.
- Conical.**—Round, and decreasing to a point.
- Convex.**—Rising or swelling on the interior surface into a spherical or round form.
- Coriaceous.**—Leathery; resembling leather.
- Corolla.**—The innermost of the envelopes by which the organs of fructification of many flowers are covered; the second of two envelopes that surround the stamen and pistil.
- Culinary.**—Relating to the kitchen.
- Culm.**—The stalks or stems of corn or grasses.
- Curd.**—The thickened part of milk, which is formed into cheese.
- Curvilinear.**—Having a curved line.
- Cutaneous.**—Belonging to the skin.
- Cuticle.**—The thin, exterior coat of the skin.
- Decoction.**—The strength of leaves, seeds, or other matter, drawn out by boiling.
- Defecate.**—To free from impurities; to purify.
- Dentata.**—Pertaining to the teeth.
- Dentated.**—Having points like teeth.
- Dew-lap.**—The flesh that hangs from the throat of oxen, which laps or licks the dew, in grazing.
- Diadelphous.**—Having the stamens united in two parcels.
- Diagonal.**—Being in an angular direction.
- Diameter.**—A right line passing through the centre of an object, from one side to the other.
- Dichotomous.**—Regularly divided by pairs.
- Disk.**—The whole surface of a leaf; the fleshy substance between the stamens and pistil.
- Diuretic.**—Tending to produce discharges of urine.
- Drench.**—A draught; a portion of medicine to purge a beast.
- Drupe.**—A general name for a one-celled, one or two-seeded fruit, which does not open when ripe, as the peach, cherry, plum, &c.
- Edible.**—Fit to be eaten as food.
- Electricity.**—A very thin fluid diffused through most bodies, rapid in its motion, and powerful.
- Elliptical.**—Oval.
- Elongation.**—The state of being extended.
- Elytra.**—The sheaths of an insect; a case covering the wings.
- Emarginate.**—Having a notch at the point.
- Emasculation.**—Castration.
- Embracing.**—Enclosing; clasping; holding in embrace.
- Embrocation.**—The liquid with which an affected part is washed.
- Embryo.**—Anything in its first rudiments, or unfinished state.
- Epidermis.**—A thin membrane, covering the skin of animals or the bark of trees.
- Erosion.**—Eaten away; corrosion; canker.
- Esculent.**—Any plants fit for food; though sometimes used as a general name for edible roots.
- Esophagus.**—The gullet; the canal through which food and drink pass to the stomach.
- Espalier.**—A row of trees planted about a garden or in hedges.
- Expression.**—The act of pressing or squeezing out.
- Extravasated.**—Forced or let out of its proper vessels.
- Exude.**—A discharge of moisture, juice, or liquid, by bodies and plants.
- Fallowing.**—Ploughing and harrowing land without sowing it.
- Farina.**—Fine dust or powder contained in the anthers of plants.
- Farinaceous.**—Mealy; pertaining to meal.
- Faucet.**—The spigot of a barrel.
- Febrile.**—Pertaining to fever.
- Fecal.**—Containing or consisting of dregs, sediment or excrement.
- Fecula.**—The green matter of plants; starch or farina.
- Fecundation.**—The act of making fruitful or prolific; impregnation.
- Fermentation.**—Internal motion of the particles of animal and vegetable substances, occasioned by heat or moisture, and causing an extrication of gas and heat.
- Ferruginous.**—Partaking of iron.
- Fetlock.**—A tuft of hair growing behind the pastern joint of many horses.
- Fetus.**—The young, in the womb or egg, when perfectly formed.
- Fibrous.**—Composed or consisting of fibres.
- Figment.**—A thing feigned or imagined.
- Filament.**—A fibre; a fine thread, of which flesh, nerves, skin, plants, roots, &c., are composed.
- Filiform.**—Having the form of a thread or filament.
- Filtrate.**—To purify; to strain.

- Fining.**—The purification of substances by the addition of ingredients which separate and deposit the objectionable matter.
- Flaccid.**—Soft and weak; limber.
- Flank.**—The fleshy part of an animal's side between the ribs and the hip.
- Fleshy.**—Plump; pulpy.
- Flitch.**—A hog's side salted and cured.
- Flocculent.**—Adhering in locks or flakes.
- Floret.**—A little flower.
- Foment.**—To bathe with warm liquors.
- Fructification.**—Rendering productive of fruit.
- Fulcrum.**—A prop or support.
- Fungus.**—A mushroom; a spongy excrescence.
- Fusiform.**—Shaped like a spindle.
- Gastric.**—Belonging to the belly or stomach.
- Germen.**—The ovary or seed-bud of a plant.
- Gestation.**—Carrying young in the womb from conception to delivery.
- Girt.**—A bandage or strap.
- Glaucous.**—Dull green; having a bluish tinge.
- Globular.**—Round; spherical.
- Globule.**—A small particle of matter of a spherical form.
- Glume.**—The outer covering of corn and grasses; the husk or chaff.
- Gluten.**—A tough, elastic, gray substance, found in the flour of grain.
- Gramineous.**—Pertaining to grass.
- Granulation.**—The act of forming into grains.
- Gypsum.**—Plaster-stone.
- Hackle.**—Raw silk; any flimsy substance unspun; a machine to dress flax or hemp.
- Haulm.**—Straw; the stem or stalk of grain. &c.
- Headland.**—A ridge or strip of unploughed land at the ends of furrows, or near a fence.
- Heathery.**—A place overgrown with shrubbery of any kind.
- Hemispherical.**—Containing half a sphere or globe.
- Herbaceous.**—Having green and cellular stalks; being annual as to stem, but perennial as to root.
- Hexagonal.**—Having six sides and six angles.
- Hispid.**—Rough; having stiff hairs or bristles.
- Hoar-frost.**—White particles of ice formed by the congelation of dew or watery vapors.
- Hoary.**—Having a grayish hue.
- Hock.**—Joint of an animal between the knee and the fetlock; a part of the thigh.
- Holm.**—Low, flat, rich land, on the banks of a river.
- Hopper.**—A wooden trough through which grain passes into a mill; a vessel in which seed-corn is carried for sowing.
- Horizontal.**—Parallel to the horizon; on a level.
- Hybrid.**—Mongrel; an animal or plant produced from the mixture of two species.
- Hydatid.**—A bladder-like animal, filled with aqueous fluid, which infests the human internal organs particularly the liver; an insect found in the skulls of sheep.
- Hydraulic.**—Relating to the conveyance of water through pipes.
- Hydrogen.**—A gas constituting one of the elements of water.
- Imbricated.**—Indented with concavities; overlapping.
- Impervious.**—Not penetrable by light, nor permeable to fluids.
- Incised.**—Cut; notched.
- Incisive.**—Having the quality of cutting or separating; incisive teeth, in animals, are the fore teeth.
- Indigenous.**—Native to the country or place.
- Injection.**—Throwing in; liquid medicine thrown into the body by means of a syringe or pipe.
- Innoxious.**—Free from mischievous qualities.
- Integument.**—That which naturally invests or covers another thing.
- Internode.**—The space between two joints of a plant.
- Interstice.**—The space between things.
- Iridescent.**—Having colors like the rainbow.
- Irrigation.**—A mode of watering land by the aid of drains or canals.
- Jugular.**—Pertaining to the throat or the neck.
- Keel.**—The two lowest petals of some flowers.
- Labial.**—Pertaining to the lips.
- Lachrymal.**—Generating or secreting tears.
- Lanceolate.**—Shaped like a lance.
- Larva.**—An insect in the caterpillar state.
- Larynx.**—The upper part of the windpipe; a cartilaginous cavity.
- Latent.**—Concealed.
- Lateral.**—Proceeding from the side.
- Lea.**—A meadow or plain.
- Legume.**—Fruit similar to the pod of a pea.
- Lever.**—A bar of any substance turning on a support called the fulcrum or prop.
- Ligament.**—Anything that ties or unites one thing or part to another; a strong substance, serving to bind one bone with another.
- Ligneous.**—Consisting of wood.
- Line.**—The twelfth part of an inch.
- Linear.**—Consisting of lines; slender; in a straight direction.
- Lithe.**—That may be easily bent; pliable; limber.
- Lobby.**—A small hall or waiting-room.
- Lobe.**—A division of a leaf.
- Longitudinal.**—Running lengthwise.
- Lotion.**—A liquid preparation for washing the body.
- Lupulin.**—The fine yellow powder of hops.
- Macerate.**—To steep in water until nearly dissolved.
- Mal-odorous.**—Having an offensive odor.
- Manipulate.**—To work with the hands; to handle.
- Marl.**—A species of limy earth.
- Matrice.**—The womb; the place where anything is formed or produced.
- Mattock.**—A tool to grub up weeds.
- Maw.**—The stomach of beasts; the crop of fowls.
- Membrane.**—A thin, white, flexible skin.
- Metacarpal.**—Part of the hand between the wrist and the fingers.
- Metamorphose.**—To change into a different form; to transform.
- Miasmata.**—Pertaining to putrefactive effluvia.
- Midge.**—A small insect; a gnat or flea.
- Midrib.**—The middle rib or vein of a leaf.
- Milch.**—Giving milk.
- Molting.**—Shedding a natural covering, as hair, feathers, skin, or horns.
- Mongrel.**—Of a mixed breed.

- Mucilage.**—One of the elements of vegetables; the liquor which moistens the joints of animal bodies.
- Mucous.**—Slimy; glutinous.
- Mulch.**—Half-rotten straw.
- Mullion.**—A division in a window-frame; a bar.
- Must.**—Unfermented wine, newly pressed from the grape.
- Nasal.**—Pertaining to the nose.
- Navicular.**—Shaped like a boat.
- Nitrogen.**—An element of air called azote, fatal to animal life.
- Nocturnal.**—Pertaining to the night.
- Normal.**—Perpendicular; relating to rudiments or first principles.
- Noxious.**—Hurtful; harmful.
- Oblique.**—Not direct; slanting.
- Oblong.**—Longer than broad.
- Obovate.**—Having the narrow end downward.
- Obtuse.**—Blunt; not pointed or acute.
- Occipital.**—Pertaining to the back part of the head.
- Offset.**—A shoot; a sprout from the roots of a plant.
- Organic bodies.**—Bodies with organs on the action of which depend their growth and perfection.
- Oster.**—Willow twig.
- Ova.**—Eggs.
- Oval.**—Of the shape or figure of an egg.
- Ovary.**—The part where eggs are formed, or in which the fetus is supposed to be formed.
- Ovate.**—Egg-shaped.
- Oviparous.**—Bringing forth, or producing young by eggs.
- Ovule.**—A body destined to become a seed.
- Ovum.**—Egg-shaped.
- Oxygen.**—That part of air which may be breathed; vital air, or the basis of it.
- Pad.**—A road; an easy-paced horse; a soft saddle; to beat a way smooth and level.
- Paddock.**—A small enclosure for animals.
- Palmed.**—Having the shape of a hand; webbed.
- Palpi.**—Feelers.
- Panary.**—Pertaining to bread.
- Panicle.**—A species of flowering; unfolding of blossoms.
- Parallelogram.**—A figure whose opposite sides are equally distant throughout.
- Parasitic.**—Growing on the stem or branch of another plant.
- Parietal.**—Bones forming the sides and upper part of the skull.
- Parterre.**—Level ground laid out and furnished with evergreens and flowers.
- Pastern.**—That part of a horse's leg between the joint next to the foot and the coronet of the hoof.
- Peccant.**—Morbid; bad; not healthy.
- Pedicle.**—The final division of a common stem or stalk.
- Peduncle.**—The flower-stalk of a plant.
- Pellet.**—A little ball.
- Pellicle.**—A thin skin or film.
- Pelt.**—A beast's skin, with hair on it; a raw hide.
- Peltato-palmate.**—Having the shape of a hand, and of a rough hairy texture.
- Pelvis.**—The cavity of the body forming the lower part of the abdomen.
- Pendulous.**—Hanging from a stem or branch.
- Perch.**—A pole; a roost for fowls.
- Percolation.**—The act of filtering or straining.
- Perennial.**—Lasting through the year; a plant which lives more than two years.
- Perforate.**—To bore through; to make a hole or holes through anything.
- Permeable.**—That may be passed through without displacement of its parts.
- Perspective.**—View in the distance.
- Pervious.**—That may be penetrated by another body or substance.
- Petal.**—A flower-leaf.
- Petiole.**—A leaf-stalk; the foot-stalk of a leaf.
- Phenogamous.**—Having stamens and pistils distinctly visible.
- Phosphate.**—A salt formed by a combination of phosphoric acid with a base of earth, alkali, or metal.
- Pile.**—The hairy surface of an animal's skin.
- Pinnate.**—Divided into a number of pairs of leaflets.
- Pistil.**—An organ of female flowers adhering to the fruit for the reception of the pollen.
- Plait.**—A fold; a tress; braid.
- Pledget.**—A small, flat roll of lint or linen.
- Pollard.**—A tree lopped.
- Pollen.**—The fine fecundating dust or flour contained in flowers.
- Polygamous.**—Having male and hermaphrodite, or female and hermaphrodite, or male, female, and hermaphrodite flowers, on the same, or different plants.
- Pomace.**—The substance of ground apples, either before or after the cider is expressed.
- Porous.**—Filled with pores, which are passages in the skin or substance of a body.
- Posterior.**—Coming after; the hinder.
- Postern.**—Back; any small door or gate.
- Probang.**—An instrument of whalebone and sponge, for clearing the throat or gullet.
- Proboscis.**—A snout; an organ formed by the prolongation of the nose.
- Prolegs.**—Fore legs.
- Propolis.**—A thick, odorous substance, resembling wax.
- Pubescent.**—Covered with down or hair.
- Pupa.**—An insect in that state in which it resembles an infant in swaddling clothes.
- Purgative.**—Having the power of cleansing; evacuating the bowels.
- Purge.**—A medicine that evacuates the body by stool.
- Pus.**—The white or yellowish matter generated in ulcers and wounds.
- Quadrangular.**—Square; having four sides, and four prominent angles.
- Quicklime.**—Any limy substance deprived of its fixed or carbonic air.
- Racemose.**—Having the flowers arranged along an axis, as in the hyacinth and currant.
- Rachis.**—A stem that proceeds from the base to the top of the flower.
- Ratooming.**—Sending up many stalks from an old root; several crops being thus gathered from one planting.
- Rectangular.**—Right-angled.

- Rectum.**—The third and last of the large intestines.
- Reflected.**—Bent, or directed backward.
- Reniform.**—Having the shape of kidneys.
- Rick.**—A long pile of grain or hay, sheltered with a kind of roof.
- Rootlet.**—A small root, or the fibre of a root.
- Rugose.**—A leaf with veins more contracted than the surface.
- Rump.**—The end of the backbone of an animal, with the parts adjacent.
- Saccharine.**—Having the qualities of sugar.
- Saline.**—Consisting of salt.
- Scape.**—The flowering stem of a plant.
- Scarify.**—To scratch; to make small incisions in the skin with an instrument.
- Scion.**—A young shoot, twig, or sprout of a tree.
- Serotum.**—The place containing the organs of generation.
- Scully.**—A place where dishes, kettles, &c., are kept.
- Seedling.**—A young plant or root just sprung from the seed.
- Segment.**—A part cut off or divided.
- Semilunar.**—Resembling in form a half moon.
- Septic.**—Promotive of putrefaction.
- Serous.**—Thin; watery.
- Serration.**—Formation in the shape of a saw.
- Serum.**—Thin, transparent part of blood; the thin part of milk.
- Sessile.**—Applied to a leaf growing on a stem without having any foot-stalk.
- Setiform.**—Having the form of a bristle.
- Seton.**—Small threads, or a twist of silk, drawn through the skin by a large needle, for the discharge of humors.
- Sheath.**—A rudimentary leaf of a plant which wraps around the stem.
- Shock.**—Sixteen sheaves of wheat, rye, &c.
- Slet.**—A broad, flat, wooden bar.
- Sole.**—The bottom of a thing, and on which it stands upon the ground.
- Solitary.**—Growing singly.
- Spatula.**—A slice; an instrument for spreading plasters, &c.
- Spermatie.**—Consisting of seed, or pertaining to the elements of production.
- Spike.**—A species of inflorescence, as in wheat, rye, &c.; an ear of corn or grain.
- Spikelet.**—A small spike; one of a great many small spikes collected in a mass, as in grass.
- Spine.**—A large, woody thorn.
- Spiracle.**—A small aperture in animal and vegetable bodies through which air passes; any small hole or vent.
- Spongule.**—A supposed expansion of minute parts at the termination of roots, like a sponge, for absorbing the nutriment of plants.
- Spore, Spore.**—The part of flowerless plants which performs the function of seeds.
- Stallion.**—A male horse not castrated.
- Stamen.**—An organ of flowers for the preparation of the pollen or fecundating dust.
- Standard.**—A tree or shrub that stands singly without being supported.
- Stellate.**—When more leaves than two surround the stem in a ring; resembling a star; radiated.
- Sternum.**—The breast-bone.
- Stifle.**—The joint of a horse next to the buttock.
- Stigma.**—The top of the organ of female flowers.
- Stipule.**—A scale at the base of the leaf-stalks of some plants; or one which protects the young leaves.
- Stomata.**—Oval spaces between the sides of cells, in plants, opening into other cavities, and bordered by a rim.
- Stool.**—A sucker; a shoot from the bottom of the stem or root of a plant.
- Strata.**—Beds; layers.
- Strike.**—The name given to a single running of ungranulated sugar.
- Style.**—The middle portion of the organ of female flowers, connecting the stigma with the germ.
- Sub-lanceolate.**—Having somewhat of a lance shape.
- Sub-sessile.**—Having very short foot-stalks.
- Subsoil.**—The bed or layer of earth which lies beneath the surface-soil.
- Subulate.**—Shaped like an awl.
- Subulate-linear.**—Having awl-shaped lines.
- Succulent.**—Full of juice; juicy.
- Sucker.**—The shoot of a plant from the roots or lower part of the stem.
- Sulphate.**—A neutral salt, formed by sulphuric acid in combination with any base.
- Sulphuric.**—Containing sulphur.
- Suture.**—The seam or joint which unites the bones of the skull; a method of closing wounds.
- Sward.**—The grassy surface of land; turf.
- Swath.**—The whole breadth or sweep of a scythe in mowing or cradling.
- Talc.**—A greasy-feeling magnesian mineral, having a pearly lustre, used instead of chalk for tracing lines on wood, cloth, &c.
- Tarsi.**—Belonging to the feet.
- Tassels.**—The flower ribbons, or heads of plants, as of corn.
- Temporal.**—Pertaining to the temple or temples of the head.
- Tension.**—Strained or stretched.
- Tenuous.**—Thin; small; minute.
- Tepid.**—Moderately warm.
- Terminal.**—Growing at the end of a branch or stem; terminating.
- Terrace.**—A raised bank of earth, with sloping sides; a balcony.
- Testicles.**—Male organs of generation.
- Thorax.**—The breast; the chest; the part of the body between the neck and abdomen; the second segment of insects.
- Tibia.**—The bones which form the second segment of the leg.
- Tonic.**—A medicine that gives vigor and action to the system.
- Transpiration.**—Passing off through the pores of the skin.
- Transverse.**—Lying or being across, or in a cross direction; to overturn.
- Trench.**—To cut or dig a ditch or channel; to fortify, by cutting a ditch and raising a rampart; to furrow, by ploughing.
- Trepanning.**—Opening the skull, to relieve the brain.

- Trichotomous*. — Having three divisions.
- Triennial*. — Lasting for three years.
- Trifoliate*. — Having three leaves or leaflets.
- Trocar*. — An instrument for tapping in case of dropsy.
- Tubercle*. — A small swelling, tumor, knob, or rough point.
- Tuberous*. — Roundish, fleshy vegetable bodies, connected into a bunch by intervening threads.
- Tunicated*. — Covered with a tunic or membranes; coated, as a stem.
- Uterus*. — The womb.
- Vacuum*. — An empty space; one void of air or matter.
- Valve*. — A division of the fruit of a plant.
- Vell*. — A skin; a rennet-bag.
- Ventral*. — Belonging to the belly.
- Verandah*. — An open portico, formed by extending a sloping roof beyond the main building.
- Vertebra*. — A joint of the spine or backbone of an animal.
- Vertical*. — In a perpendicular direction.
- Vestibule*. — The porch or entrance into a house; an ante-room.
- Vexillum*. — The upper single petal of a flower like that of a pea.
- Viscid*. — Glutinous; sticky.
- Viviparous*. — Producing young in a living state.
- Wattle*. — The fleshy bunch under the throat of a cock or turkey.
- Wear*. — A dam in a river to stop and raise the water.
- Whey*. — The watery part of milk separated from the thick part, in making cheese.
- Whorled*. — An arrangement of three or more leaves or limbs around a common centre.
- Windlass*. — A machine for raising great weights; a handle by which anything is turned.
- Withers*. — The junction of the shoulder-bones of a horse, at the bottom of the neck.
- Folk*. — The oily secretion from the skin of sheep, which renders the pile soft and pliable.
- Zig-zag*. — Having short turns.

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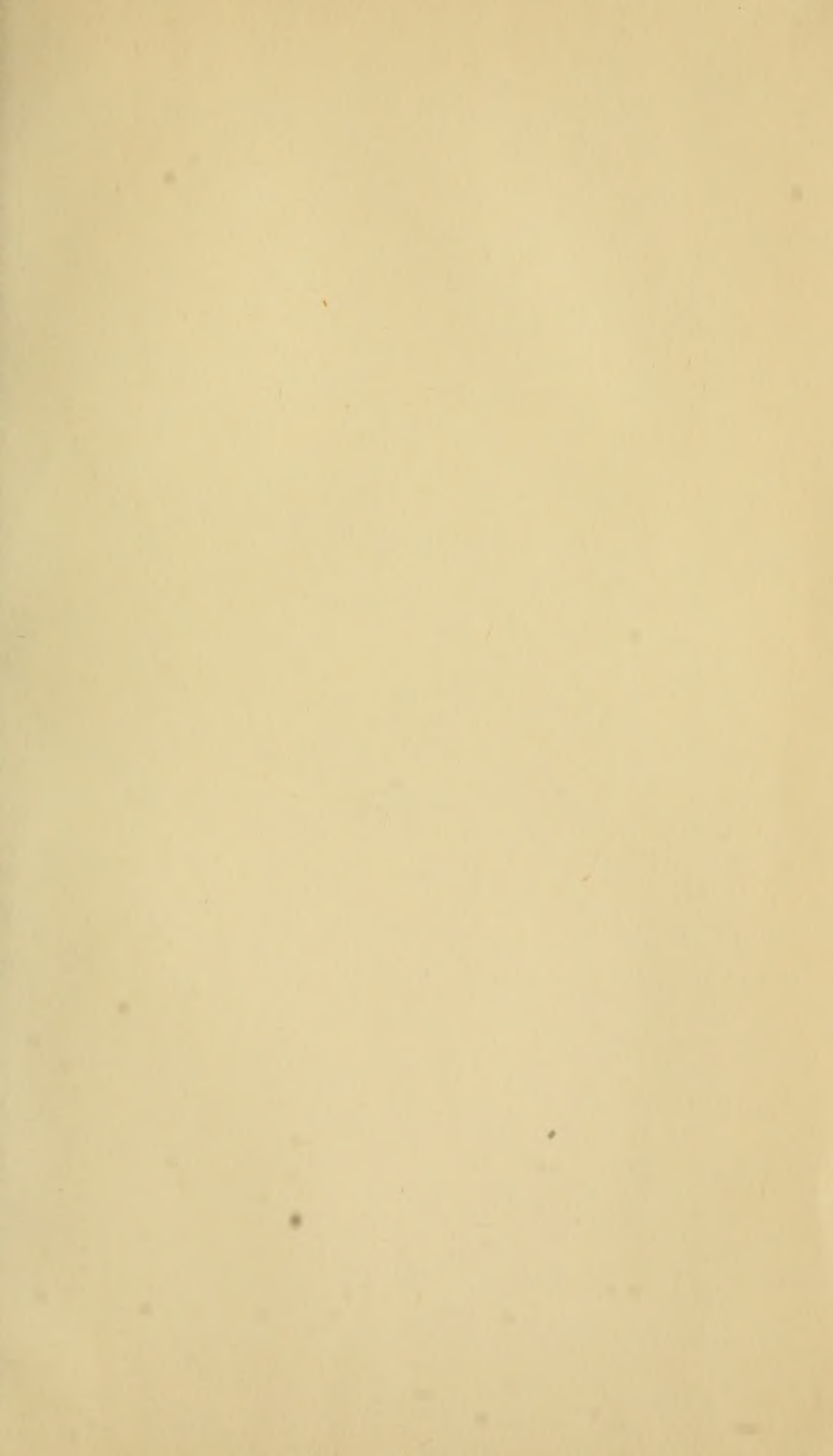
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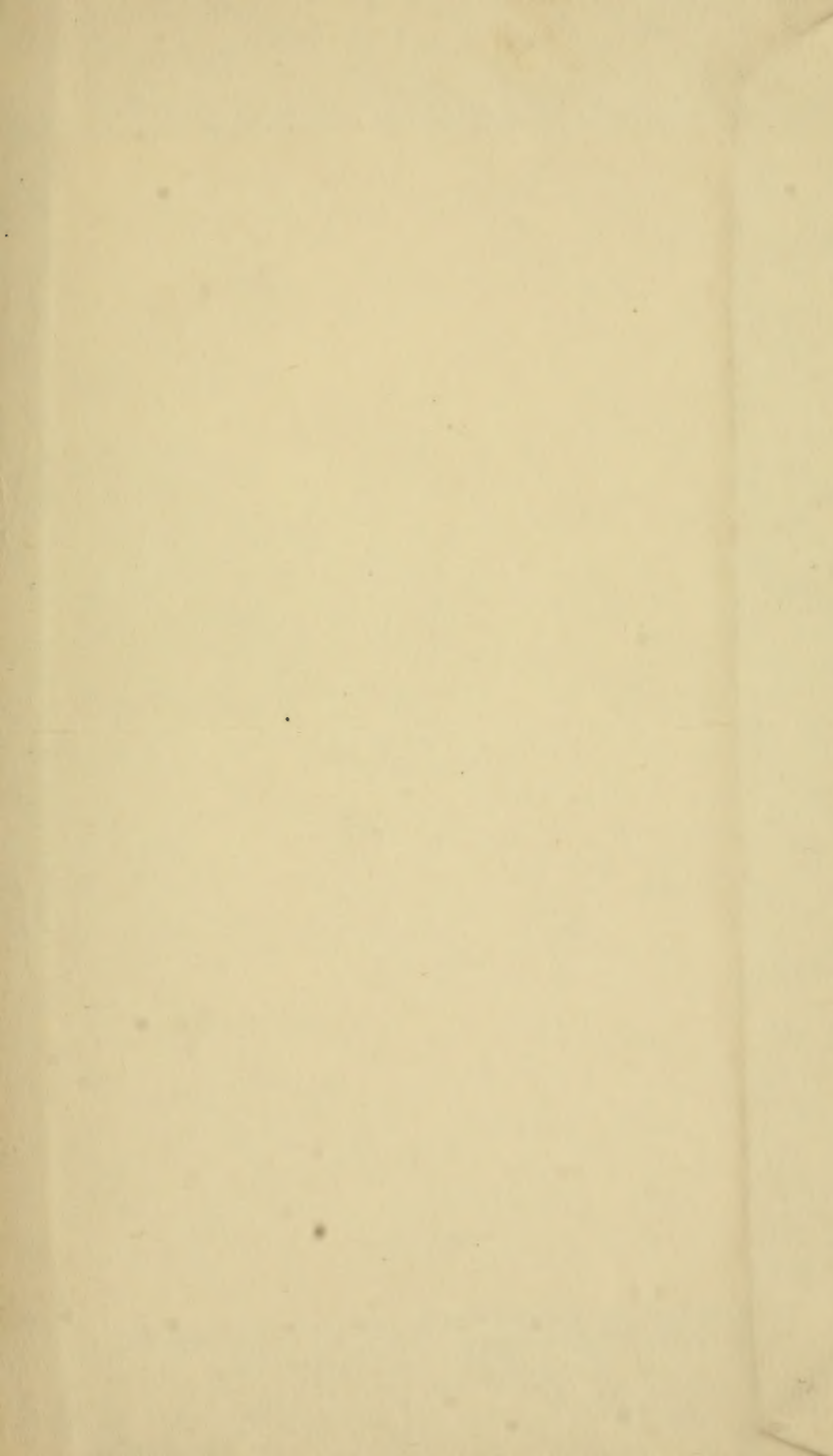
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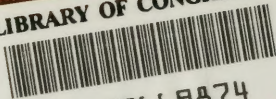
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